4-2011

Biofuels in Heating Oil, 2011

Maine Governor's Office of Energy Independence and Security

Paul R. LePage
Governor
State of Maine

Kenneth C. Fletcher
Director
Governor's Office of Energy
Independence and Security

STATE OF MAINE
OFFICE OF THE GOVERNOR
22 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0001

PAUL R. LEPAGE
GOVERNOR

KENNETH C. FLETCHER
DIRECTOR
OFFICE OF ENERGY
INDEPENDENCE AND SECURITY

April 2011

Honorable, Senate Chair Thomas B. Saviello
Honorable, House Chair James M. Hamper
Joint Standing Committee on Environment and Natural Resources
115 State House Station
Augusta, Maine 04333-0115

RE: Biofuels Report 2011

Dear Senator Saviello and Representative Hamper:

The 124th Legislature enacted *RESOLVE Chapter 210 LD 1632, Resolve, Regarding Biofuel in Number 2 Heating Oil* whereby the Governor's Office of Energy Independence and Security (OEIS) is required to oversee a study of the energy, environmental and economic feasibility of setting a requirement for the percentage of biofuel to be used in number 2 heating oil.

The OEIS is submitting these findings and recommendations to the Joint Standing Committee on Environment and Natural Resources. The report examines:

- The feasibility of linking annual production of biofuel in the State to use goals and requirements;
- Consideration of biofuel supply, price and infrastructure issues for number 2 heating oil;
- Consideration of federal regulations and programs, including, but not limited to, the United States Environmental Protection Agency's renewable fuels standard and the United States Department of Agriculture's biomass crop assistance program;
- Consideration of relevant legislative proposals and actions in the United States Congress, including, but not limited to, low-carbon fuel standards;
- Consideration of relevant policies in other states, particularly in other New England states; and
- Conformance of goals with the State of Maine Comprehensive Energy Action Plan.

If you have any questions regarding the report, please do not hesitate to contact us.

Sincerely,

Kenneth C. Fletcher

Kenneth C. Fletcher
Director, Governor's Office of Energy
Independence and Security

Acknowledgements

Jeffrey Marks, Deputy Director of the Governor's Office of Energy Independence and Security (OEIS) served as the primary author of this report and coordinated and communicated with interested parties and stakeholders.

I would like to particularly thank the following for their participation, information sharing, and expert input for this report.

- John Kerry, former Director of the OEIS

- James Brooks – Maine Department of Environmental Protection
- Kate Dickerson – Margaret Chase Smith Policy Center, University of Maine
- Stephen W. Fitzpatrick – Biofine Technology, LLC
- R. Alec Giffen – Maine Forest Service, Department of Conservation
- Alan Henry – Maine Bureau of General Services
- John Huber – National Oilheat Research Alliance
- Faith Huntington – Maine Public Utilities Commission
- Rebecca Lambert – Greater Portland Council of Governments
- Donald J. Mansius – Maine Forest Service, Department of Conservation
- Mark Mays – Maine Standard Biofuels
- Melissa Morrill – Maine Department of Environmental Protection
- Paul F. Nace – Maine BioProducts, LLC
- Jamie Py – Maine Energy Marketers Association
- Ronald Severance – Maine Department of Environmental Protection
- William Strauss – FutureMetrics
- Jim Therriault – Sprague Energy
- Elizabeth Wilson – Margaret Chase Smith Policy Center, University of Maine

Jon Doucette, Woodard & Curran designed the cover.

Ken Fletcher
Director
Governor's Office of Energy Independence and Security

This page intentionally left blank.

Table of Contents

Executive Summary

Maine's residences and businesses are exceedingly dependent on imported petroleum for their heating needs. Increased production and use of biofuels from food waste, wood-derived and other biomass feedstocks may eventually help alleviate and mitigate this reliance. State support for clean-burning, indigenous renewable sources of biofuels has the potential to achieve significant energy, environmental and economic advantages for Maine home and business owners. However, cost and timing considerations must be key components of any regulatory or incentive strategy to encourage and strengthen the biofuels industry.

Pursuant to *Resolve Chapter 210 (LD 1632)*, the Governor's Office of Energy Independence and Security (OEIS) is required to oversee a study of the energy, environmental and economic feasibility of setting a requirement for the percentage of biofuels to be used in number 2 heating oil. As part of this study, the OEIS considered biofuel supply, price and infrastructure issues, federal and state regulations and initiatives and the overall energy plan and goals for the State of Maine. The OEIS consulted with biofuel producers and suppliers, state agencies, non-governmental organizations and industry representatives on the role of biofuels in Maine and potential policy options to encourage the development and use of biofuels in number 2 heating oil.

The OEIS found that a renewable fuels approach may be an effective state policy available to promote and advance the production of biofuels in Maine and its use in residential heating systems and could assist in overcoming barriers of biofuel technology development and commercialization; capital, cost and price; and supply and demand uncertainty. We find the energy, environmental and economic benefits of increased biofuel use in heating applications compelling. However, despite these benefits, federal policies to spur biofuels in thermal applications have been inadequate compared to electricity and transportation purposes and other states' experiences with biofuel mandates have raised serious cost issues, but are evolving.

Based on its examination of these issues, including the critical need to create jobs, ensure competitively-priced sources of energy, replace the use of fossil fuels and enhance Maine's energy security and long-term economic viability, the OEIS recommends a coordinated national, regional and state approach to encouraging increased biofuel penetration into the heating oil market. This may be a more efficient and economically-feasible way to approach this issue rather than a state-specific mandate, at least at this time.

National Approach to Biofuels Policy

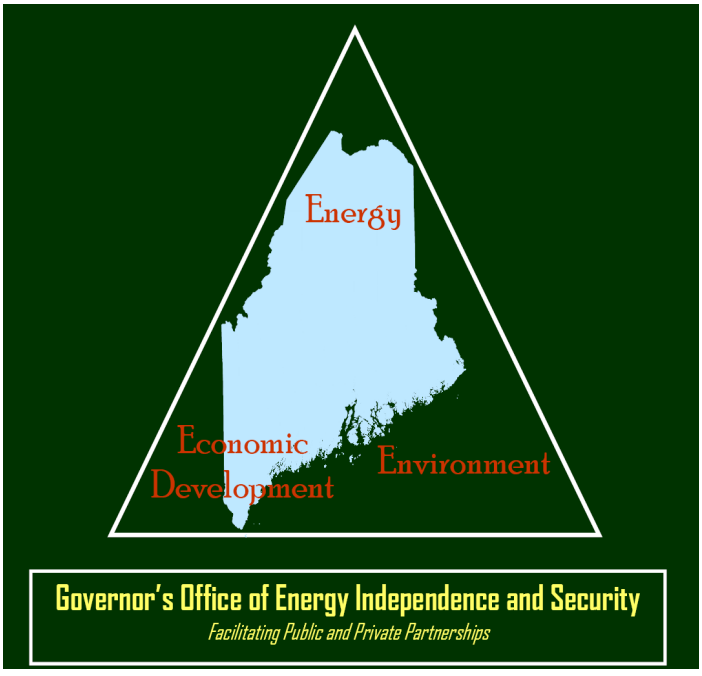
Maine should advocate with the U.S. Department of Agriculture and Environmental Protection Agency to broaden the federal Renewable Fuels Standard to increases its application to reducing reliance on #2 heating oil through use of biofuels – liquid, gaseous or solid (*e.g.*, wood chips and pellets).

Regional Approach to Biofuels Policy

Maine should continue to explore a regional low carbon fuel standard that includes a heating oil component with a focus on biofuels.

State Approach to Biofuels Policy

Maine should continue to explore how to increase the percentage of biofuels blended into number 2 heating oil at a time when policymakers are more confident in the government's, citizens' and businesses' economic conditions and financial circumstances. The OEIS in conjunction with other state agencies should develop an information database of biomass and biofuel production, capacity, supply, price and consumption resources. The State should continue to pursue the use of biofuels in state buildings and other facilities for heating purposes where economically and environmentally feasible.



Introduction

Biofuels in the Maine Energy Plan

The State of Maine is dependent on fossil fuel products to heat its homes, buildings and factories. The increasing consumption of imported petroleum is a growing factor in international, national and state environmental degradation, economic uncertainty and energy insecurity. The State of Maine Comprehensive Energy Action Plan (Maine Energy Plan) provides a short- and long-term strategy to achieve energy independence and security with clean, reliable, affordable, sustainable, indigenous and renewable resources. Through the Maine Energy Plan and its reliance on cooperative public and private partnerships, sound public policy and innovative energy programs, we can achieve the objectives of energy security, economic development and environmental quality for Maine's future.

The development and use of biofuels from home-grown, renewable resources is essential to reducing Maine's dependence on oil. In addition to fluctuating heating oil prices for Maine's citizens and businesses, the continued combustion of fossil fuels damages the environment, threatens public health and undermines economic vitality. The Maine Energy Plan encourages citizens to assess their current energy, financial and environmental profiles and to select, when possible, biofuels and other renewable energy sources as an alternative to environmentally-unfriendly fossil fuels. To that end, the Maine Energy Plan encourages development of biofuel energy plants and the use of biofuels in state, commercial, industrial and residential buildings.[1]

Supporting production and use of clean-burning, domestic biofuels to replace imported high-pollution petroleum is a national, bipartisan issue. The biofuels industry supports nearly 400,000 jobs, pays $15.9 billion in taxes, promotes energy security, reduces air pollution and climate change and promotes economic recovery, especially in hard-hit rural areas.[2] While the Maine biofuels industry is still small, it has potential to grow with increased awareness and support at the state and federal levels. In order to address technology, capital, cost and demand barriers to the use of biofuels in transportation and heating applications, policymakers are looking to research and development programs, tax incentives and "lead-by-example" initiatives to increase biofuel production and use. Renewable fuels standards, such as setting a requirement for a percentage of biofuel to be used in number 2 heating oil, could be a potentially effective state policy for encouraging biofuels production and consumption.

[1] OEIS 17
[2] OBP Weekly

Biofuels for heating oil have energy, economic and environmental benefits for Maine consumers. Cleaner heat exchangers promote better energy efficiency and reduce fuel burn of boilers and furnaces. Any fuel price premiums generated through the increased use of biofuels could be compensated by cost savings associated with longer equipment life and reduced maintenance and cleaning of heating equipment. Because the petroleum industry is already producing heating oil with a biofuel component – and ultra-low sulfur diesel fuels – simplified storage for one product for different applications may also contain costs. Because some biofuels can be compatible with current systems in existing residences and buildings, system retrofits to accommodate cleaner fuels may be unnecessary, keeping costs lower. Biofuels also reduce air pollutants that cause or exacerbate public health problems in the form of lung and cardiovascular disease.

Maine businesses and residences are 70-80 percent dependent on imported oil for heating purposes and nearly 100 percent reliant on petroleum for transportation. The Governor's Office of Energy Independence and Security (OEIS) supports policies that encourage clean, renewable, home-grown fuels to heat Maine's businesses and homes. However, the OEIS also recognizes that, based on current and potential heating oil and biofuel consumption and market conditions, a mandate for a percentage of biofuels to be used in number 2 heating oil is subject to careful examination because of supply and price concerns. This report examines the energy, environmental and economic feasibility of setting such a standard.

L.D. 1632 Resolve, Regarding Biofuel in Number 2 Heating Oil

Pursuant to *Resolve Chapter 210 (LD 1632) – Regarding Biofuel in Number 2 Heating Oil*, the Governor's Office of Energy Independence and Security (OEIS) is required to "oversee a study of the energy, environmental and economic feasibility of setting a requirement for the percentage of biofuel to be used in number 2 heating oil." The full Resolve reads as follows:

RESOLVE Chapter 210 LD 1632, 124th Maine State Legislature
Resolve, Regarding Biofuel in Number 2 Heating Oil

Sec. 1 Biofuel study. Resolved: *That the Executive Department, Governor's Office of Energy Independence and Security, referred to in this section as "the office," shall oversee a study of the energy, environmental and economic feasibility of setting a requirement for the percentage of biofuel to be used in number 2 heating oil. As used in this section, "biofuel" means any commercially produced liquid or gas used to fire a heating device or a stationary power device or otherwise substitute for liquid or gaseous fuels that is derived from renewable biomass, including, but not limited to, agricultural*

crops and residues, forest products and by-products and separated food waste, as distinct from petroleum or other fossil carbon sources.

1. The study must include, but is not limited to, the following:

A. The feasibility of linking annual production of biofuel in the State to use goals and requirements;

B. Consideration of biofuel supply, price and infrastructure issues for number 2 heating oil;

C. Consideration of federal regulations and programs, including, but not limited to, the United States Environmental Protection Agency's renewable fuels standard and the United States Department of Agriculture's biomass crop assistance program;

D. Consideration of relevant legislative proposals and actions in the United States Congress, including, but not limited to, low-carbon fuel standards;

E. Consideration of relevant policies in other states, particularly in other New England states; and

F. Conformance of goals with the office's State of Maine Comprehensive Energy Plan.

2. The study must supplement the January 2008 report by the office titled "Liquid Biofuels Policy for Maine" and update recommendations regarding the establishment of an alternative fuel incentive program to stimulate the production, distribution and use of biofuels in number 2 heating oil.

3. In carrying out the study, the office shall consult with the Department of Environmental Protection, the Public Utilities Commission and the Efficiency Maine Trust Board.

4. Performance of the study's examination of supply goals and requirements and price considerations under subsection 1 is dependent on receipt of funding through a 3rd-party grant or donation. Performance of the study's update of policy recommendations to stimulate the production, distribution and use of biofuels, with supply goals and price considerations, must be undertaken by the office regardless of funding source.

5. By February 15, 2011, the office shall submit a report of its findings and recommendations, together with any necessary implementing legislation, to the joint standing committee of the Legislature having jurisdiction over natural resources matters; and be it further

Sec. 2 Authority to submit legislation. Resolved: *That the joint standing committee of the Legislature having jurisdiction over natural resources matters may submit a bill relating to the subject matter of the report submitted pursuant to section 1 to the First Regular Session of the 125th Legislature.*

Development of Report

The OEIS study examines the feasibility of linking annual production of biofuel to use goals and requirements; biofuel supply, price and infrastructure issues; federal and other states' regulations; and conformance of goals with the State of Maine Comprehensive Energy Action Plan. The study makes recommendations regarding the establishment of an alternative fuel requirement to stimulate the production, distribution and use of biofuels in number 2 heating oil. In order to address technology, capital, cost and demand barriers to the use of biofuels in heating oil applications, we must examine renewable fuels standards, such as a biofuel requirement for heating oil, as a potentially effective state policy for encouraging biofuels production and consumption.

In order to respond to LD 1632, the OEIS sought information, data, advice and suggestions from Maine's biofuel producers, petroleum dealers, marketers and distributors, government agencies, policymakers, academic institutions, non-governmental organizations and industry representatives. As required by LD 1632, the OEIS also consulted with the Department of Environmental Protection, the Public Utilities Commission and the Efficiency Maine Trust. The OEIS posed the set of questions in **Appendix A** to all stakeholders for their input and received various levels of detail to these questions, incorporated responses into the report and relied upon existing third-party studies, resources and experts for background and additional information. Based on its examination, the OEIS makes recommendations that attempt to balance the energy, economic and environmental implications of a renewable fuels standard for heating oil.

Petroleum for Heating

Roughly one-third of the Nation's energy demands are for thermal heat, hot water, cooling, and industrial process heating applications.[3] Residential heating fuel choices are dependent on, and limited by, a variety of factors, including the cost and availability of the fuel source; types of appliances used to convert the fuel to heat and how the heat is distributed; efficiency of the equipment; and the environmental impacts of the fuel. In New England, heating oil and electricity are the primary sources for heating, propane and wood are prevalent in rural areas and natural gas is becoming increasingly available. Renewable energy sources, such as solar, are occasionally used for supplemental heating and hot water and wood pellets are becoming gradually more popular and available, especially as the price of petroleum products goes up.

While only about 5 percent of total petroleum used in the country is used for residential and commercial purposes, with a portion devoted to space heating, approximately 8.5 million households in the United States (out of 111 million) use heating oil as their primary heating fuel. Figure 1 shows the hold that petroleum has over the transportation and industrial sectors of the U.S. economy, with a smaller impact on the residential and commercial sectors. Residential space heating is the main use and the demand is seasonal with most consumption during October through March. See Figure 2. As discussed below, Maine's reliance on petroleum for heating purposes significantly outpaces the rest of the country.

[3] EIA, DOE, *2009 Annual Energy Review*

Figure 1 – U.S. Primary Energy Flow by Source and Sector, 2009
(Quadrillion Btu)

Total = 94.6

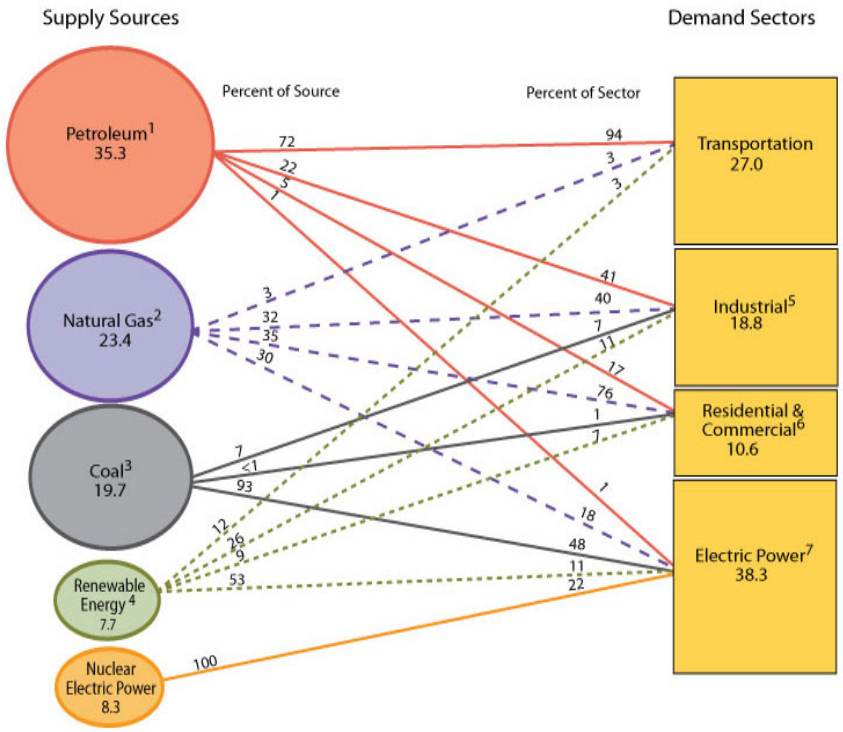
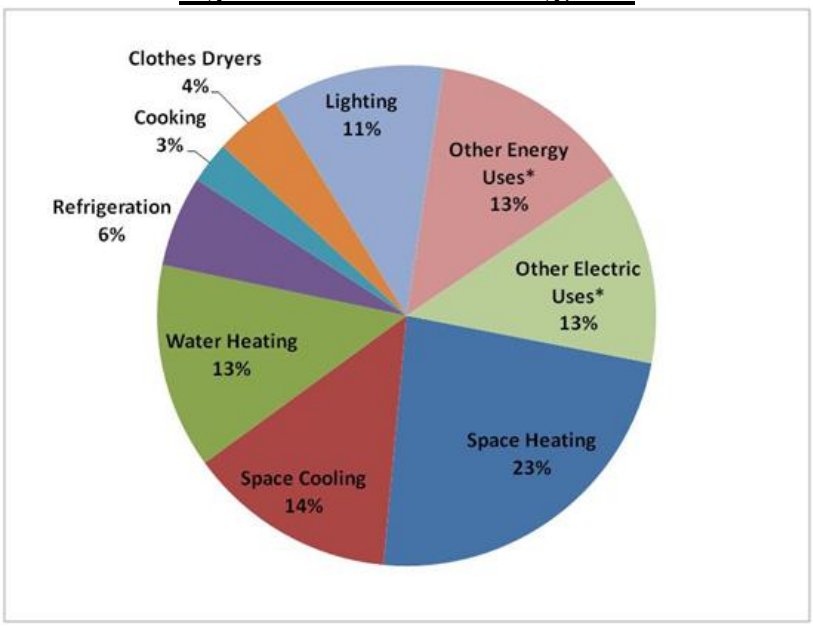


Figure 2 – Residential Energy Use

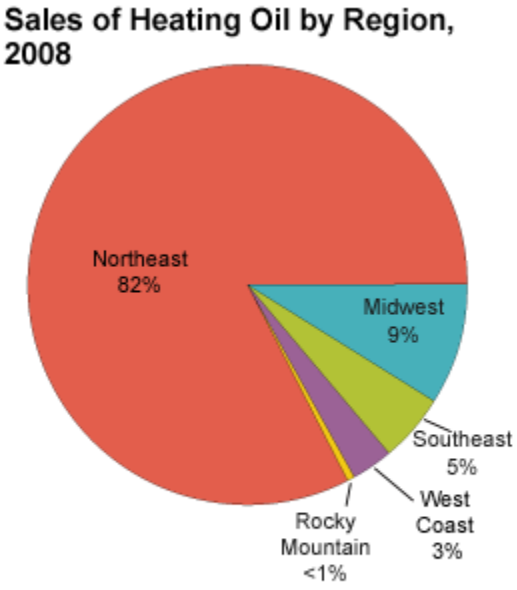


Source: Pew Center on Global Climate Change

Of the 8.5 million households in the United States that heat their homes with heating oil, about 6.5 million households are located in the northeast region. Northeast consumers use about 82 percent of the nation's home heating oil, with an average of 5.5 billion gallons used annually for residential, commercial and industrial heating purposes.[4] See Figure 3.

[4] EIA, DOE, *Heating Oil Explained*

Figure 3 – Sales of Heating Oil by Region, 2008

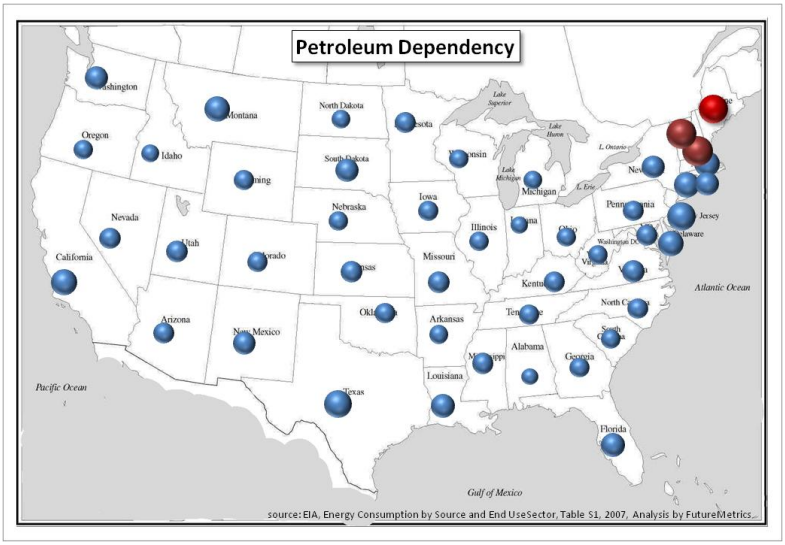


Source: U.S. Energy Information Administration, *Fuel and Kerosene Sales 2008* (December 2009).

Much of the revenue from heating oil sales in New England and other northeastern states does not remain in the Northeast.[5] According to FutureMetrics, based on analysis of Energy Information Administration data, Maine will "export about $720,000,000 because Maine homes use about 300 million gallons a year of heating oil and every dollar spent on heating oil leaves the Maine economy."[6] Maine has no fossil fuel reserves but instead receives all of its petroleum products from abroad primarily by ship and pipeline. Figure 4 graphically displays Maine's petroleum dependency relative to other parts of the country.

[5] Strauss, July 2010
[6] Strauss, January 2011

Figure 4 – Petroleum Dependence in the Northeast

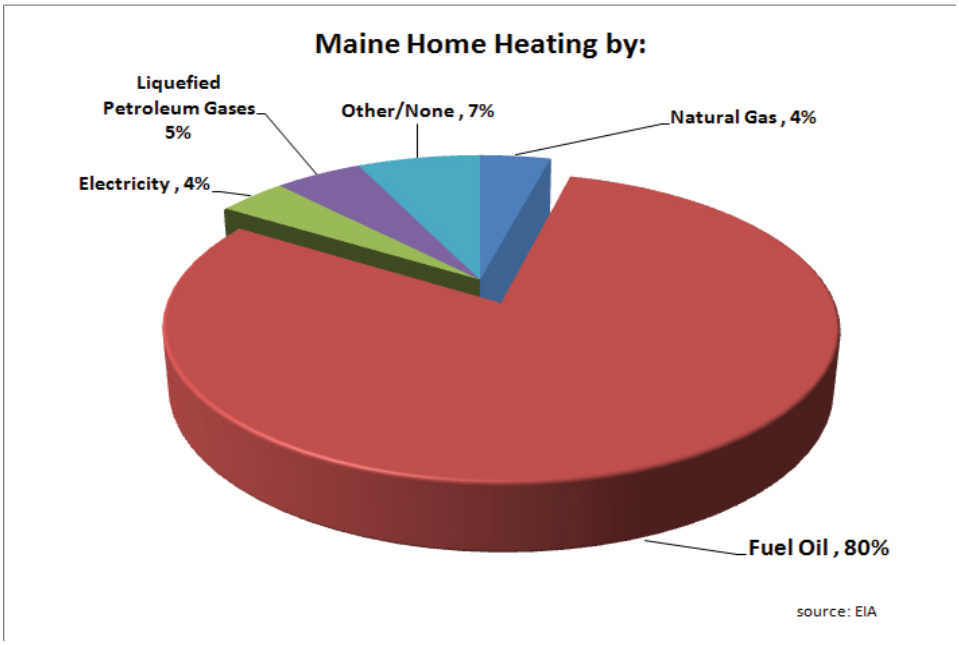


Source: Analysis by FutureMetrics

Maine uses approximately 1.6 billion gallons of petroleum products annually with 613.8 million gallons in distillate fuel. Maine's per capita petroleum consumption is high due to the widespread use of fuel oil for home heating during the long, cold winters. Maine's overwhelming reliance on imported fossil fuels makes it particularly vulnerable to painful price volatility, fuel supply disruptions and price spikes, especially during winter months.[7] Figure 5 breaks out Maine's fuel use for residential heating purposes.

[7] http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=ME

Figure 5 – Maine Home Heating by Fuel Source



As mentioned, Maine has no refining capacity. About half of the heating oil in Maine comes from the Gulf Coast via pipeline to New Jersey with waterborne deliveries to Maine (including South Portland, Calais and Searsport). The other half arrives by truck and marine transportation from Canada (including the Irving refinery in New Brunswick). Once in Maine, there are primary three storage components: primary terminal facilities which receive bulk loads of product; secondary storage facilities; and tertiary distribution facilities with local tank storage. The primary storage facilities are limited in capacity and can typically distribute about 4-5 days worth of heating oil. Maine's location at the end of the supply line, dependence on marine transport and extreme winter weather conditions make it particularly vulnerable to supply shortages.[8]

Heating oil prices in a given geographic region of the State may be higher or lower than the statewide average. The differences in pricing reflect a variety of factors, including transportation costs from the oil terminals in southern Maine to dealers in northern Maine. Cooler temperatures in Maine may lead to increased demand for heating oil and therefore, increased prices. Southern Maine can more readily access other sources of energy, specifically natural gas, lessening the demand and keeping prices lower. Price

[8] OEIS, State of Maine Energy Emergency Plan

competition among dealers may be a factor in differences in prices, even within the same geographic regions. The volatile price of WTI crude oil on the national and international levels and unpredictable geopolitical events are major drivers of heating oil prices in Maine and around the United States. The forecast for heating oil prices is difficult to predict, but trends show volatility in prices combined with increases over time.

Maine citizens have taken a variety of approaches to lower their heating oil consumption and/or bills. Some arrange to have their tanks filled when prices are generally lower (but not always) in the late summer or early fall. Others enter prepaid plans whereby they pay up front for their heating fuel at a fixed price for the season. Boiler and furnace optimization, cleaning and maintenance plans are available to increase the energy efficiency of their equipment. Energy efficiency activities, such as insulation, air sealing, weather stripping, programmable thermostats, have increased as a result of rebate and tax incentive programs. Federal and state energy assistance programs, such as the Low Income Home Energy Assistance Program, are available to those heating oil customers with a limited budget.

Figure 6 demonstrates the strong relationship between crude oil and Maine heating oil prices during the last decade.

Figure 7 charts the same trend of just heating oil prices in Maine. For archived heating oil prices and trends in Maine, please visit www.maine.gov/oeis/heatingoil.htm.

Figure 6 – Relationship between Heating Oil and Crude Oil Prices – 2000 - 2010

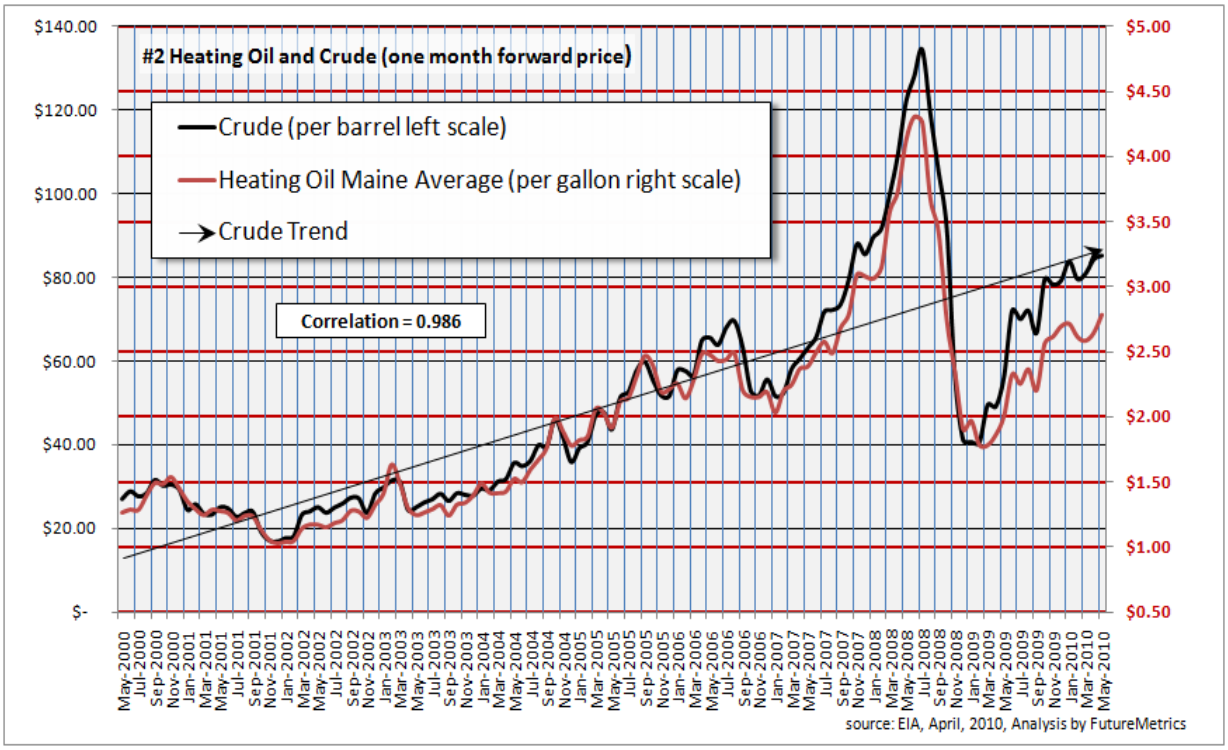
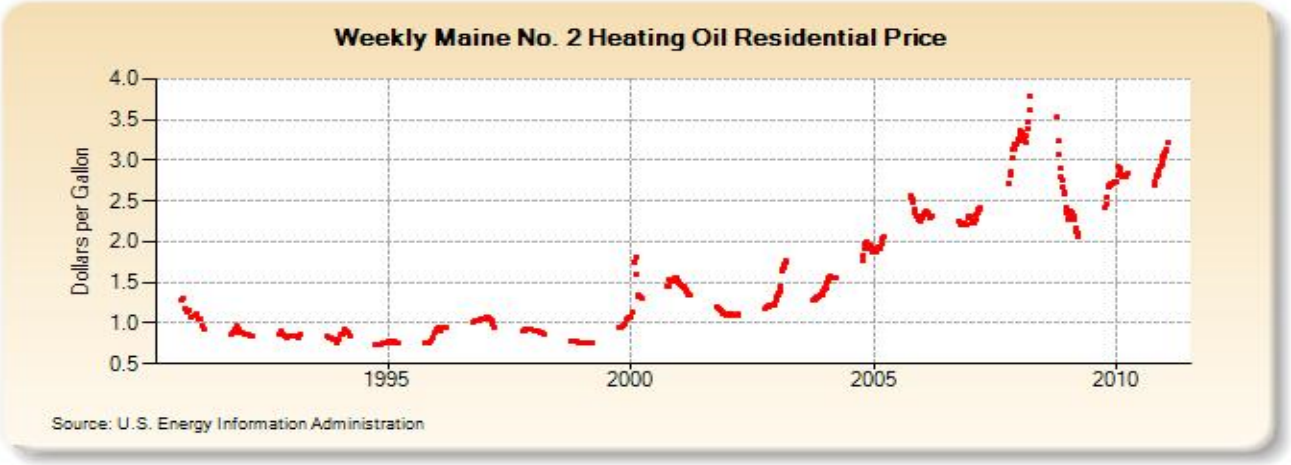


Figure 7 – Weekly Maine No. 2 Heating Oil Residential Price



Currently, only about 4 percent of the region's thermal needs are met by renewable energy resources like biomass, solar and geothermal and 4 percent through limited access of natural gas. At the same time, biomass has been used to heat homes for centuries in fireplaces, wood stoves, furnaces and boilers. Pellet stoves and furnaces and biofuel blends in heating oil are more recent applications.

The Definition and Role of Biofuels

The term "biofuels" and "biodiesel" are often used interchangeably to refer to fuels made from biomass, which is organic material from trees, plants and crops, and waste materials (*e.g.*, wood waste, municipal wastes, landfill gas). In this report and in LD 1632, "biofuel" is defined as:

> *"any commercially produced liquid or gas used to fire a heating device or a stationary power device or otherwise substitute for liquid or gaseous fuels that is derived from renewable biomass, including, but not limited to, agricultural crops and residues, forest products and by-products and separated food waste, as distinct from petroleum or other fossil carbon sources.*

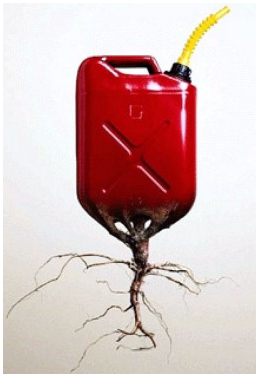


Photo: TrendsUpdates.com

"Biodiesel" is typically defined as a liquid biofuel that can be used as an alternative for heating oil but is more commonly used to describe an alternative for transportation diesel fuel made primarily from vegetable oils, recycled cooking grease and animal fats. According to the Brookhaven National Laboratory definition, biodiesel is blended with petroleum-based diesel, at up to 20 percent (called B20 blend stock), for trucks and heavy-duty vehicles.[9] The Maine Department of Environmental Protection defines "biodiesel fuel" as:

> *renewable fuel composed of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats that is registered with the United States Environmental Protection Agency as a fuel and a fuel additive under the federal Clean Air Act, Section 211(b), 42 United States Code, Section 7545 and as otherwise specified in the American Society for Testing Materials Standard D6751-02a or its subsequent Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels.*[10]

[9] Brookhaven, Biofuel Research
[10] Sec. 2, 36 MRSA, Sec. 3202, sub-section 1-A

The *Energy Independence and Security Act of 2007*, discussed in more detail in the "National Policies" section, sets minimum standards for blending "advanced biofuels" into the renewable fuels standard (RFS) primarily for transportation fuels. According to the EISA, "advanced biofuels" are:

> *renewable fuels, other than ethanol derived from corn starch, that have lifecycle greenhouse gas emissions that achieve at least a 50 percent reduction over baseline lifecycle greenhouse gas emissions and may include ethanol derived from cellulose or lignin, sugar or starch or waste material, including crop residue, other vegetative waste material, animal waste and food and yard waste; biomass-based diesel; biogas produced through the conversion of organic matter from renewable biomass; butanol or other alcohols produced through the conversion of organic matter from renewable biomass; and any other fuel derived from cellulosic biomass.*[11]

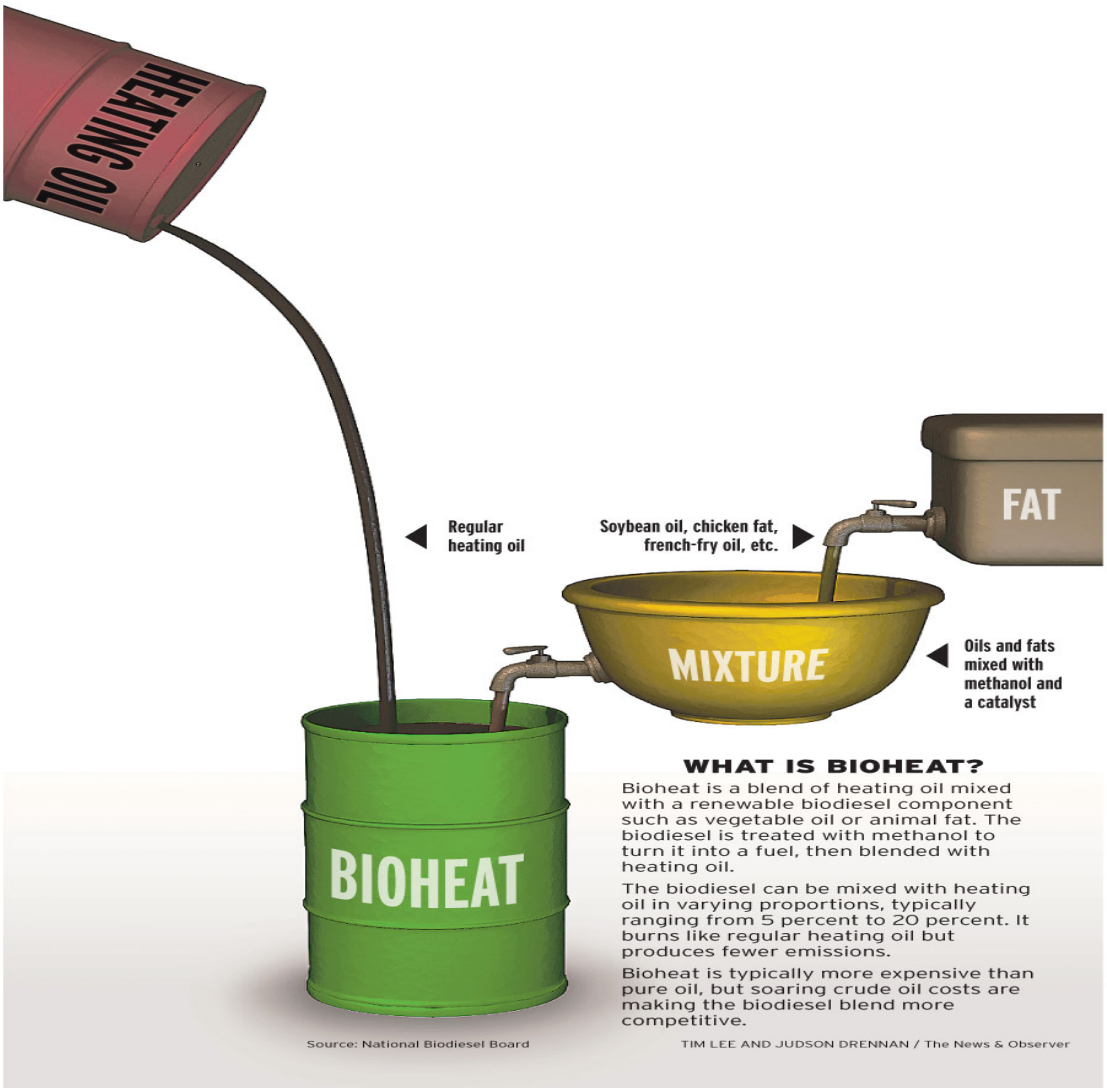
Another term, "bioheat," refers to the use of biomass specifically to produce heat. The National Oilheat Research Alliance (NORA) and the National Biodiesel Board (NBB) are using the term Bioheat® fuels to describe a mixture of heating oil and biodiesel. Their goal is to develop a uniform name that consumers will recognize with the name trademarked to NORA and made available to retail and wholesale oil dealers.

Unless otherwise specified, we will use the term "biofuels" as it is defined in LD 1632 for heating purposes, but it is important to note the various definitions in different regulatory contexts.

Biofuels, or biodiesel, are similar to diesel fuel and commonly blended with diesel or other distillate fuels, such as number 2 heating oil. It has a higher gel temperature than diesel, so pure biodiesel can cause problems in cold weather. Biodiesel is often blended with diesel in a 20 percent biodiesel, 80 percent diesel ration (B20) or in a 5 percent biodiesel, 95 percent diesel ration (B5).[12] B20 can be used in unmodified diesel engines or stationary boilers. It can be used in its pure form (B100) but may require engine modifications to avoid maintenance and performance problems.[13] Currently, most blends are B5.

[11] EISA, P.L. 110-440
[12] Rockefeller 7
[13] EPA, What You Should Know About Biodiesel in New England

Figure 8 – What is Bioheat?



Biomass feedstocks come from a variety of organic matter sources. Crops grown for both agriculture and energy uses are used for biomass feedstocks: corn to produce ethanol; rapeseed to produce biodiesel; sorghum for ethanol; soybeans to produce biodiesel; sugarcane to produce ethanol; and microalgae for liquid biofuels. Wood and wood waste (*e.g.*, bark, sawdust, chips, scrap and paper mill residues) are particularly important in Maine. Biomass feedstocks from waste materials include biogas from wastewater treatment plants, animal feeding operations and landfills; biosolids from sewage sludge; crop residues; and food processing waste.[14]

[14] EPA, State Bioenergy Primer, 8 - 9

Potential opportunities exist in the forest and wood industries in Maine for increased production and use of biomass and cellulosic feedstocks:

- Forest residues from silviculture, or wood harvesting, including limbs and tops and dead or dying trees. A collection infrastructure is in place to harvest the wood.
- Mill residues: bark, chips, sander dust, edgings, sawdust, slabs and black liquor from manufacturing operations like sawmills and pulp and paper companies. Almost 98 percent of mill residues generated in the United States are currently used as fuel or to produce wood pellets, fire logs, or other wood products.
- Wood pellets and other compressed wood products have higher energy content by weight (approximately 7,750 Btu per pound at six percent moisture content) than many other biomass feedstocks due to their high density and low-moisture content. Relatively easy to store.
- Forest thinnings, including underbrush, saplings, dead or dying trees.

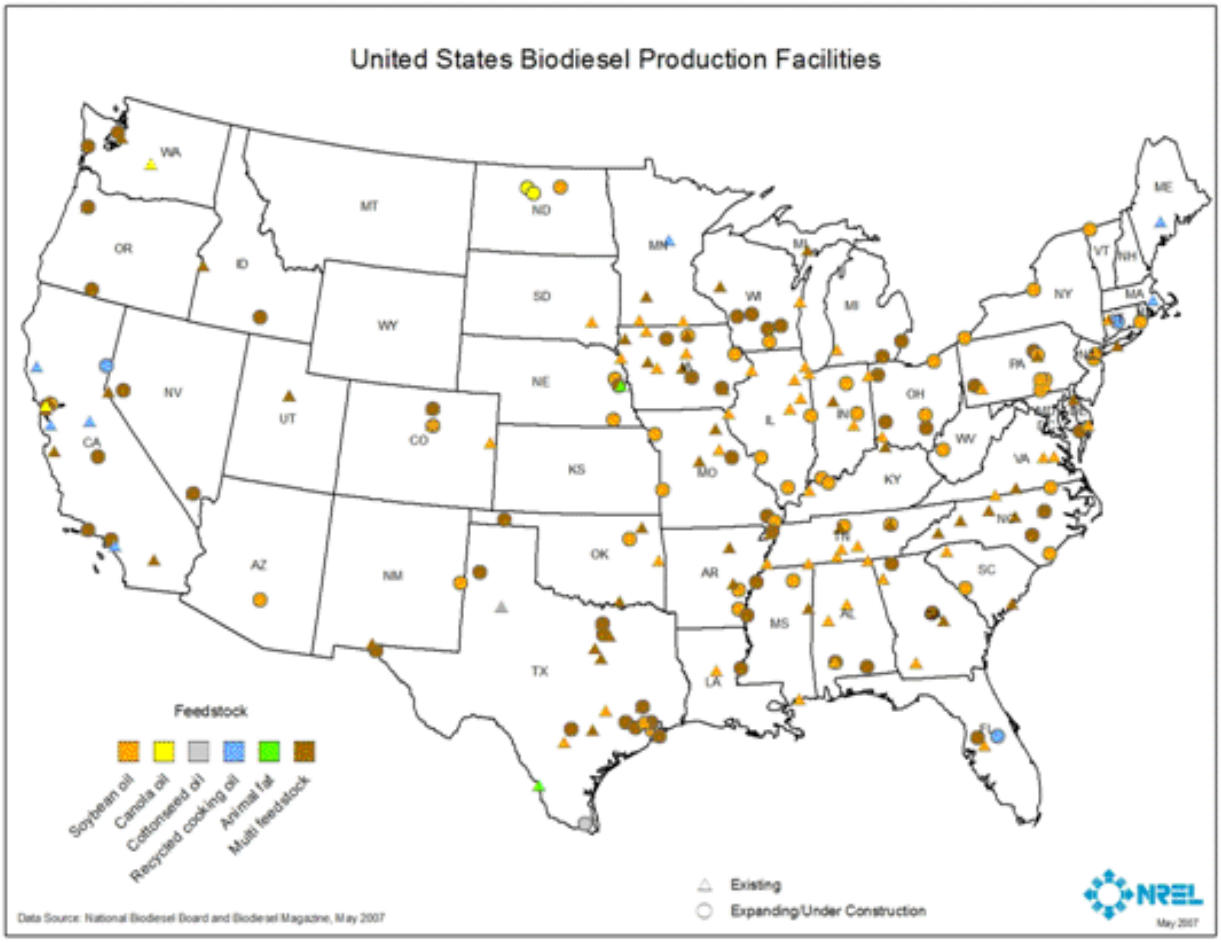
If biomass and biofuels from Maine wood products can replace a significant amount of oil cleanly and efficiently at a substantial savings for consumers in terms of dollars per Btu, the State should pursue cost-effective options to spur production and use.[15]

Municipal solid waste (MSW) can be used as a fuel in waste-to-energy (WTE) facilities. In 2010, 86 WTE plants were operating in 24 states with a capacity to process more than 97,000 tons of MSW per day. The nation's WTE facilities have the capacity to generate the energy equivalent of 2,790 megawatt hours of electricity.[16] Maine currently has four WTE operators with a combined capacity of approximately 2,800 tons per day and 65.3 megawatts. Restaurant wastes, including vegetable oils, animal fats and grease can also be used as biomass feedstocks for biofuels/biodiesel. Small-scale efforts have been successfully implemented in Maine.

[15] EPA, State Bioenergy Primer
[16] Michaels

Currently, there are about 176 commercial biodiesel plants in the United States with about 2.6 billion gallons/year capacity, but only 0.7 billion gallons produced in 2008.[17] See Figure 9.

Figure 9 – U.S. Biodiesel Production Facilities.



[17] McCormick

This page intentionally left blank.

Biofuels in Maine

2008 Report and Conclusions

In January 2008, the Governor's Office of Energy Independence and Security (OEIS) submitted a report to the Maine Legislature entitled, "Liquid Biofuels Policy for Maine." At the time, Maine was using more than 600,000 gallons of pure biodiesel (0.3% of the diesel market), approximately ten times as much as 2004. Maine's only producer at the time, Green Bean Bio-Fuel, produced approximately 150,000 gallons of biodiesel from waste grease in 2007. Maine had a number of policies in place and under consideration to address technology, capital, cost, demand and lack of pumps. These policies included support of research and development; tax incentives for new pumps, production and consumption; state use of biofuels; and revolving funds for capital investment. Implementation problems were prevalent and included lack of funding, tight stipulations, complicated paperwork and conflicting goals and timelines.[18]

The 2008 report examined the following 16 policy options to encourage the production and use of biofuels in Maine[19]:

1. Doing nothing. The biofuels industry may continue to grow in the face of inaction, but is likely to struggle without state action.

2. Alternative fuels grant incentive program. Distributes funds to grantees for purchasing and producing biofuels to address the cost and capital barriers, but difficult to implement effective grants due to complicated paperwork and timing issues.

3. Hiring an alternative fuels point person. This may be a good use of state funds to aid the Maine biofuels industry through grant application, streamlined permitting, matching producers with investors, identifying potential locations for production and supporting restaurants who contribute waste grease for production.

4. Sustainability certification. Environmental groups supported third-party certification of wood as a feedstock for biofuels to ensure sustainable practices and conservation, but others had concerns about "stifling the nascent biofuels industry."

5. Dedicated alternative fuels research and development fund. R&D programs are

[18] Rockefeller, p. 1
[19] Ibid, pp. 38-65

designed to overcome technological and economic barriers to alternative fuels. Overcoming these barriers are key to unlocking new technological advancements in biofuels production while also stimulating the economy and creating jobs. However, R&D involves risk and money and may be better approached at the federal level.

6. Increasing producers' credit. While Maine had a five cent per gallon production credit, the average biofuels credit among states with this incentive was 15 cents. If limited to locally-owned plants, local feedstocks and sustainability-certified feedstocks, the production credit could spur instate production, new jobs and economic development. However, the cost to the State is a factor.

7. Pump pilot program. The challenge of installing and operating renewable fuel pumps across the state, in addition to cost and uncertain demand, may overwhelm the potential benefits of creating the distribution infrastructure needed to push instate production of biofuels.

8. Pump lease program. A novel approach for the State to buy pumps and tanks and lease them to potential suppliers leery of making a significant capital investment during uncertain demand would lower the risk and cost to Maine.

9. Reviving the Clean Fuel Vehicle Fund. Revolving loan funds are attractive means to sustain alternative fuel programs and investments, but are only as successful as far as their funding mechanisms are robust and sustained.

10. Exempting biofuels from exclusivity contracts. This option provides a relatively low risk and inexpensive way to encourage biofuels distribution if not aggressively opposed by the petroleum industry.

11. Rewriting/reinstating the excise tax cut. Maine's biodiesel excise tax was controversial because it cost the State more than anticipated. However, it is an effective way to increase supply and production.

12. Department of Transportation (DOT) biodiesel use. "Lead-by-Example" is a key component of the State of Maine Comprehensive Energy Action Plan. Use by State government in transportation fleets could pave the way for increased use in residential and commercial buildings. While guaranteeing demand for producers and suppliers, this policy can be costly to the State depending on the premium.

13. School bus program. Promoting biodiesel use in school buses can increase health benefits and biodiesel distribution, but also entails a cost to the State.

14. Flex-fuel vehicles in state fleets. Fleet purchasing requirements may guarantee some demand for ethanol, supporting infrastructure development.

15. Renewable Fuels Standard. See discussion below.

16. Low Carbon Fuel Standard. See discussion below.

The 2008 report found that a renewable fuels standard appeared to be the most effective state policy for encouraging biofuels production and consumption, followed closely by government leadership and per gallon tax incentives. The report recommended that the State of Maine pursue a renewable fuels standard (RFS) or a low carbon fuel standard (LCFS) at a regional level. The Maine Climate Action Plan explored this possibility but stakeholders could not come to a consensus on it at the state level – many environmental groups favored this approach while the oil industry opposed it. There was a concern that Maine's market is too small to require fuel dealers to make adjustments specific to Maine. However, the Department of Environmental Protection and other agencies could pursue these policies at a regional level and are moving in this direction.

A RFS can work two ways:

1. Require a certain amount of biofuel consumption total (as in the federal RFS); or,
2. Require a certain percent biofuel blend in all petroleum fuels (as is the related topic of this study).

Most states have opted for the latter approach which is easier to implement. The benefits include a low cost to the state and assessed increase in consumption, distribution and production. Drawbacks are likely political resistance and cost concerns.[20]

A LCFS is a performance-based standard for fuels that regulates carbon-intensity or lifecycle carbon emissions from fuels.[21] It requires displacement of high-carbon fuels with fuels that have low-carbon intensity, such as biofuels. While focused on transportation applications, a LCFS can also be adapted and include heating oil. In December 2009, the Governors of 11 Northeast and Mid-Atlantic States, including Maine, signed a memorandum of understanding affirming each state's commitment to collaborate on a LCFS and develop a proposed program framework by early 2011.

For a copy of the 2008 Liquid Biofuels in Maine report, please visit http://www.maine.gov/oeis/publications.html.

[20] Rockefeller, pp. 61-63
[21] Cooper

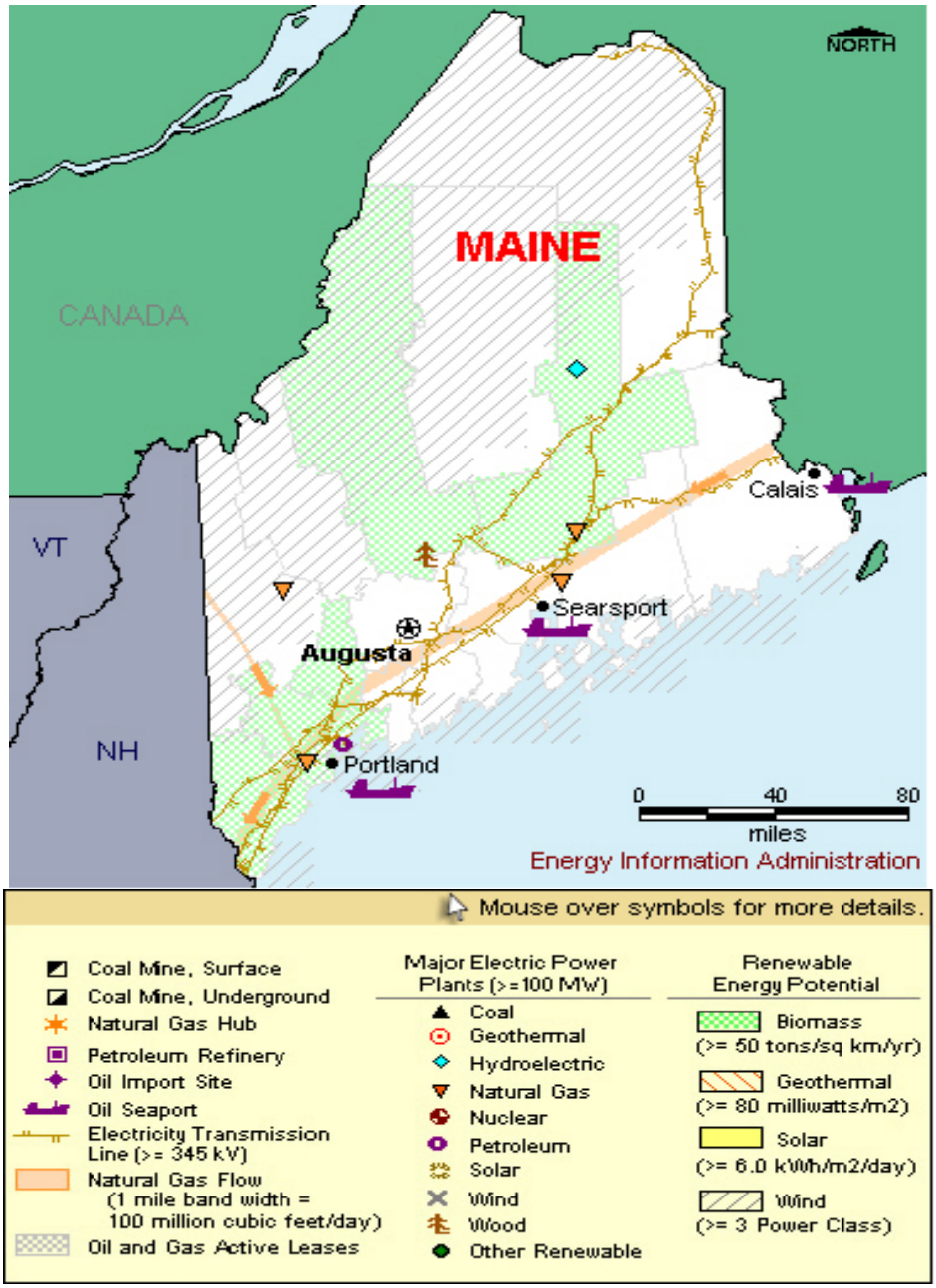
Biofuels Potential in Maine

The U.S. Department of Agriculture estimates in its 2010 Biofuels Strategic Production Report that two percent of advanced cellulosic biofuel production, mostly from woody biomass, will come from the Northeast. Under the USDA scenario, the region could produce 423.7 million gallons of advanced biofuels from 639,150 acres of dedicated bioenergy crops (mostly perennial grasses) plus 1.7 million acres of harvested logging residue in a year. This will take 11 biorefineries, producing 40 million gallons a year, costing $320 million per biorefinery for a total cost of $3.52 billion cumulative investment over time.[22] In order to achieve the renewable biofuels requirements, a rapid build-up in production capabilities is needed, as is a substantial monetary investment for biorefineries. Barriers to infrastructure must be overcome and the federal government, Congress, states, industry and others must be prepared to facilitate a biorefinery system.

Maine is the country's most heavily forested state with 90 percent of its land classified as forested. Maine's forests provide a tremendous source of renewable energy. According to a Maine Forest Service assessment of sustainable biomass availability, Maine's forest industry harvests 15 – 17.5 million "green tons" annually and the wood available for energy purposes could be increased by approximately 9.7 million tons per year if the economic feasibility of extracting, transporting and utilizing these potential sources of supply was viable. This is a 50-60 percent increase over current levels of harvest.[23] Due to Maine's low population size and abundance of woody biomass, it has the potential to replace a large percentage of its own non-renewable energy with renewable energy from its forest and become a much more energy self-sufficient state. Figure 10 presents a DOE map highlighting the vast expanse of Maine with actual and potential biomass resources.

[22] USDA, pp. 9-10
[23] Maine Forest Service

Figure 10 – Maine Energy Resources, EIA



Source: U.S. Energy Information Administration, http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=ME.

A number of existing studies estimate the potential of biofuels production to displace petroleum use in Maine. According to an analysis by the Margaret Chase Smith Policy Center, 30 percent of the country's energy needs could be met from utilizing all biomass sources and Maine could meet 18 percent of its transportation fuel needs through forest residues alone.[24] In 2006, the Fractionation Development Center released a report that suggested that the thermal conversion of sustainably harvested forest biomass could meet 50 percent of Maine's fuel needs.[25] In 2007, the University of Maine Forest BioProducts Research Initiative predicted that Maine could meet 77 percent of its gasoline needs and 39 percent of its diesel consumption with sustainably harvested forest residues and roundwood.[26] Even with this potential, a plentiful resource and evolving technology serve no value unless economically viable methods of harvesting, producing and transporting cellulosic feedstocks can be realized.

Snapshot of Current Biofuels Production in Maine

[24] Dickerson, p. 15
[25] Rockefeller, p. 14
[26] Dickerson, p. 12

Waste grease is the only current commercial feedstock for biofuels used in Maine. (Rockefeller) Other potential feedstocks include canola, sunflowers and forest byproducts. Biofuel suppliers in Maine have had some success with selling biofuels for transportation with the highest sales occurring when the excise tax credit was in place.

The following companies have produced biofuels in Maine.

Maine Standard Biofuels (Portland, ME) produces biodiesel from waste restaurant grease, utilizing a process that recycles and reuses most of its inputs and byproducts, including methanol and glycerin. Maine Standard Biofuels is forecasting to produce 500,000 gallons of biodiesel for fiscal year 2011 using waste vegetable oil from restaurants and food manufacturers. Their projections include biodiesel for transportation fuel and bioheat for home and office heating fuel. Their facility currently has a 1,500,000 gallon capacity per year. This volume can increase significantly with modifications to the plant to accommodate market growth and demand. Their annual capacity can be increased to 3,000,000 gallons by installing additional equipment in a short period of time. Participating recycling restaurants include some of Maine's premier culinary destinations, as referenced in **Appendix B**.

Maine BioProducts/Biofine Technology (Gorham, ME) produces levulinic acid, a chemical that can be produced from virtually any type of cellulose and converted into a variety of products. Levulinic acid can be blended with ethanol to produce ethyl levulinate, a versatile biofuel. Unlike most biofuels, ethyl levulinate blends well with either diesel or gasoline. It can also be used as a home-heating fuel. When blended with biodiesel, it lowers the gel temperature, improving biodiesel's cold weather properties.

Old Town Fuel and Fiber (Old Town, ME) was developing biobutanol on a pilot scale as a complement to pulp production at a refurbished paper mill. Formerly Red Shield Environmental LLC, Old Town Fuel and Fiber switched its focus from producing ethanol to producing biobiotanol because butanol is safer to handle, can be shipped through existing pipelines and has a higher energy content.

Woods End Laboratories (Mt. Vernon, ME) brings cutting edge biogas technology called dry digestion from Germany to Maine. Dry digestion enables biogas production from 30 percent solid mixtures. This expands production potential, particularly on farms. Woods End Laboratories worked with Rainbow Valley Farm piloting on-farm biogas

production. The company also produces biogas in-house on an experimental scale. The output of this process is compost. Biogas is similar to natural gas, but is produced from the anaerobic decomposition of organic waste, such as food scraps or sewage.[27]

The ***Chewonki Biodiesel Project*** attempts to demonstrate that biofuels made from vegetable oil can replace petroleum for transportation and heating fuels. According to Chewonki, a gallon of biofuels can reduce carbon dioxide by 78 percent compared to a gallon of petroleum fuel. They also "walk the walk" by aiming to produce 3000 gallons of biofuels a year and fueling two 15-passenger diesel vans, a Volvo station wagon, three Volkswagen diesel cars, a tractor, and several staff vehicles, as well as provide supplemental heating fuel for their buildings.[28] Their product is not available to the public but is primarily used as an education tool as well as a sustainable resource for their own energy needs.

On the user side, Maine BioDiesel & BioHeat® customers have included the following:

- L.L. Bean
- The Wells Reserve
- Crystal Spring Organic Farm
- Bowdoin College
- The University of New England
- State of Maine capitol building and government offices.
- The University of Maine
- Dr. Robert Rovner
- Benjamin Construction
- Harris Organic Farm
- Strout's Point Wharf
- Little Ridge Organic Farm CSA
- Thousands of Maine home and business owners.

Courtesy of Independence Biofuel at http://www.biofuelme.com

A sample list of suppliers of biofuels in Maine is included in **Table 1** on the Efficiency Maine Web site – www.EfficiencyMaine.com/renewable-energy/biofuels. The list includes a mix of traditional heating oil distributors as well as those that focus almost exclusively on renewable fuels. At this time, there are various information resources available with differing levels of detail and updates on Maine (and other state) biofuel producers and distributors, but there does not appear to be a centralized clearinghouse of information on Maine biofuel As this list of suppliers needs to be revised on a continuous basis, the OEIS proposes a system to monitor and update an information database of

[27] Greater Portland Council of Governments
[28] Chewonki

biomass and biofuel production, capacity, supply, price and consumption resources in Maine.

Table 1 – Biofuels Supplier List -- 2008

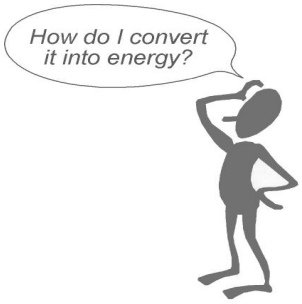
Supplier Name	Heat		Transportation		Telephone
	Blends	Delivery Area	Blends	Location	Telephone
CN Brown	-	-	B5	Wilton, Poland and Gardiner Service Plaza	
Downeast Energy	B5	Central to Southern	-	Brunswick-main office	800-339-9221
Frontier Oil	B5	Central	-	South China	800-773-2409
Giroux Oil	B5/20	South Central to Southern	-	Portland	207-797-7111
Harvest Energy	B20	Midcoast	B20	Rockport	207-230-0056
Independence Energy	B20	Southern to Midcoast	B5/20	Durham	800-228-1883
Lampron Energy	-	Oxford, Cumberland, York and Androscoggin Counties	B5/10/20	Bridgton-office	800-478-5551
Maritime Energy & Maritime Farms	B5	Knox, Lincoln & Waldo Counties	B20	Rockport & Union	800-333-4489
Pine State Services	B5	Portland, Falmouth & Scarborough Areas	-	So. Portland	207-883-8096
Proulx Oil & Propane	B20	Southern York County		New Market	800-287-1921
Rye Fuel Oil	B5	Southern York County	-	Portsmouth, NH	603-433-7408
Simply Green	B5/20	Southern Maine	B5/20	Dover, NH	603-772-3155
Sprague	-	Commercial Only	-	Portsmouth, NH	800-225-1560
Strouts Point Wharf Co.	-	-	B20	South Freeport , ME	207-865-3899
Webber Energy Fuels	B5	Statewide and some NH	-	Bangor-Corporate Office	800-238-5505
Winthrop Fuel Company	B5	Central Maine Area	-	Winthrop	207-377-8414
While every effort is made to keep this chart accurate, we rely on vendors to alert us when information					

changes. Locations are based on suppliers' physical addresses. We strongly recommend contacting a vendor to determine current business hours and exact locations. Posting here implies no endorsement by Efficiency Maine or MEIC [OEIS-ADDED – MEIC no longer exists].

Biofuels Barriers and Benefits

Barriers

The major barriers to the biofuels market include technology, capital and cost, competition and uncertain supply and demand.[29] Increased production of biofuels must take into account environmental considerations like sustainability, air and water pollution, and land use. Feedstocks must be available for a relatively fixed cost over long periods of time from a consistent source and with high heating value. Cost effective transportation, including the use of pipelines, for delivery is important. If the feedstock has more than one end use, as is sometimes the case in the forest and paper industries, competition among uses and land will affect the markets. Storage of biofuels can also be a challenge. Infrastructure, including sufficient fueling stations and distribution networks, is a key obstacle.[30] According to the Environmental Protection Agency, availability and price will ultimately determine the feasibility of the production and use of biofuels.[31]



According to a 2006 report prepared for the Maine Department of Economic and Community Development, wood-derived processed biofuels as a replacement for petroleum-derived products face a number of unique barriers including:

- Process economics – The economics of technologies are not fully demonstrated and initial commercial facilities are almost certain to run into risks and economic and technology challenges despite the opportunities available.
- High capital cost – Technologies are still in relative infancy and securing financing is difficult. Some projects in Maine are pilot, demonstration or first application and are built to learn about the technology, demonstrate potential

[29] Rockefeller, p. 19
[30] EPA, State Bioenergy Primer, pp. 35-38
[31] Ibid, p. 36

commercial viability and provide product samples. Once beyond this stage, it could cost hundreds of millions of dollars to construct a biofuels facility.

- Cost and availability of stock – The cost of feedstock often represents the largest operating expense for a biofuels facility. Prices are volatile and likely to increase as demand increases. Feedstock for energy uses competes with existing pulp and paper v. biomass-to-energy facilities. While Maine has an abundance of wood, it also has significant existing demand for wood from pulp mills, wood-fired power plants and engineered wood manufacturers. Developers need assurances that they can buy consistent volumes of wood over a period of time.
- Perspectives of scale – What is considered a large wood processing facility is considered small for a typical oil refinery. "For example, a good size Maine pulp mill may use 1 million green tons of wood a year, or about 550,000 dry tons. If this is converted to ethanol with the generous yield of 100 gallons per dry ton, this is 55 million gallons of ethanol each year. This volume is roughly equivalent to the volume of gasoline U.S. refineries currently produce in one day. In the past, this has made it difficult to get large oil and chemical companies to focus on biofuel opportunities."[32]

Biofuel Benefits

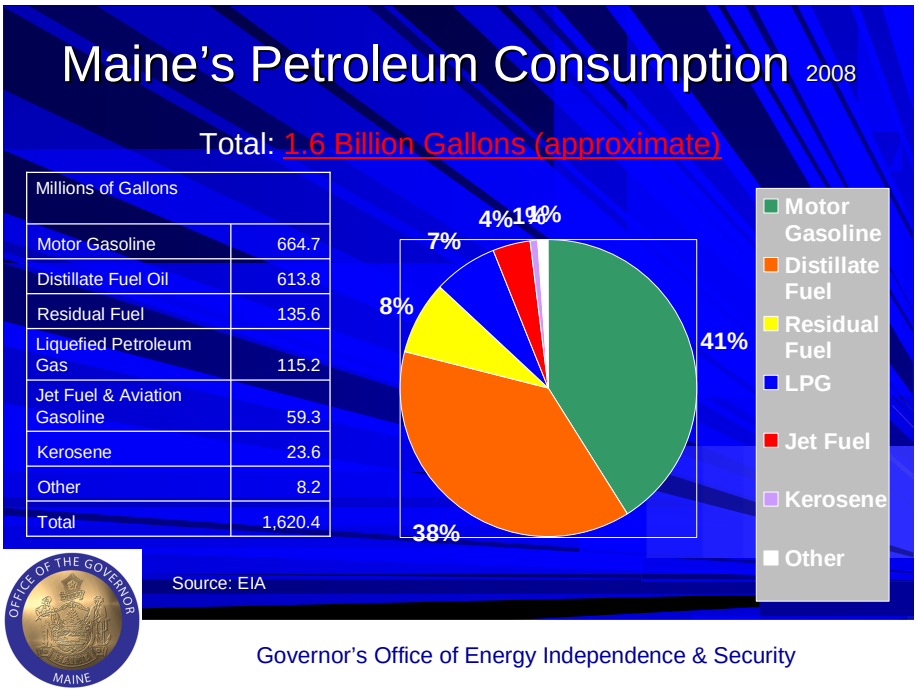
The increased use of biofuels may promote economic development, energy independence and environmental health.[33] Typical biofuel policies promote one or two of these goals more than others. Investment in instate production, for example, may yield the greatest economic benefits, but at least for the near term, may have little impact on greenhouse gas emissions abatement or energy independence, primarily because near-term instate production is limited by lack of feedstock and cost effective conversion technologies. Conversely, policies that focus on consumption and distribution may have greater benefits for greenhouse gas emission and pollution reductions and energy independence but may yield little economic benefit.[34]

Energy Benefits

The United States imports most of its petroleum, leaving the nation reliant on foreign energy sources and vulnerable to price increases and supply limits triggered by geopolitical events out of our control. Maine consumed approximately 1.6 billion gallons of petroleum in 2008, with nearly 613.8 million gallons used for distillate fuels (which include both diesel and heating oil). See Figure 11.

[32] Innovative Natural Resource Solutions, pp. 8-9
[33] Rockefeller, p. 11
[34] Ibid, p. 8

Figure 11 – Maine Petroleum Consumption, 2008



Increasing the domestic supply by expanding biofuels production, both throughout the United States and in Maine, could help reduce this dependence on foreign oil and increase energy security through the use of a renewable and sustainable fuel supply. Currently, Maine is not producing biofuels on a large scale and may not make a significant dent in fuel importation trends for some time.[35] However, we must explore potential incentives now in order to increase the chances of increased energy security later.

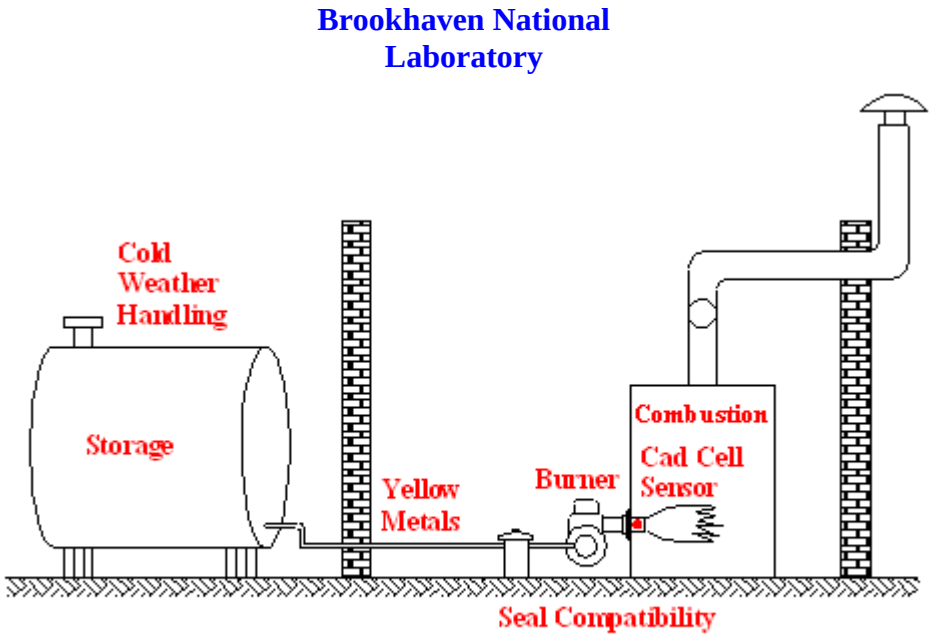
The Maine Energy Marketers Association (MEMA), in its January 22, 2010 testimony before the Joint Standing Committee on Natural Resources in support of LD 1632, estimated that a 2 percent mandate of biofuels in heating oil could replace 12 million gallons of heating oil by as soon as July 2011.[36]

In addition to the replacement of petroleum with a cleaner, renewable, indigenous fuel, the overall energy efficiency of a heating system is a key factor as to whether biofuels should be required in heating oil. The Biodiesel Board has examined and dispelled some of the common myths of biofuel use engines and fuel injection equipment in transportation applications, including its performance compared to diesel, its performance

[35] Rockefeller, p. 9
[36] Py, Jan. 22, 2010

in cold weather and its effect on engine equipment.[37] Brookhaven National Laboratory, operated on behalf of the Department of Energy, has found key performance and energy issues that may affect the operation and maintenance of heating systems using pure biofuels (B100) and blends. These include cold weather storage, material compatibility, flame emissivity and stability challenges.

Figure 12 – Operational Issues with Biodiesel Fuels



Schematic of Oil-fired Heating System Showing Areas of Attention with Biofuels

According to Brookhaven, modifications to the fuel pumps' components and safety controls and special considerations for transporting, storing and handling may be needed, all issues that are being further tested by researchers, by equipment manufacturers, and fuel specialists.[38]

The types of blends already being used and considered for expansion in LD 1632 (B2, B5, B20), in conjunction with ultra-low sulfur content fuels, may have energy efficiency and cost benefits for residential heating oil consumers. Cleaner heat exchangers may increase energy efficiency and reduce fuel burn in the boiler and furnace. Any resulting increases in price paid for a biofuel blend over regular number 2 heating oil could be countered by cost savings through longer equipment life and reduced maintenance and

[37] National Biodiesel Board
[38] Brookhaven National Laboratory

cleaning of the equipment. Because the petroleum industry is already producing ultra-low sulfur diesel fuel and biofuel blends, simplified storage for one product for different applications may also contain costs. Since both ultra-low sulfur heating oil and biofuels are compatible with current systems in existing buildings and residences, the avoidance of system retrofits to accommodate the cleaner fuels may also keep down costs.

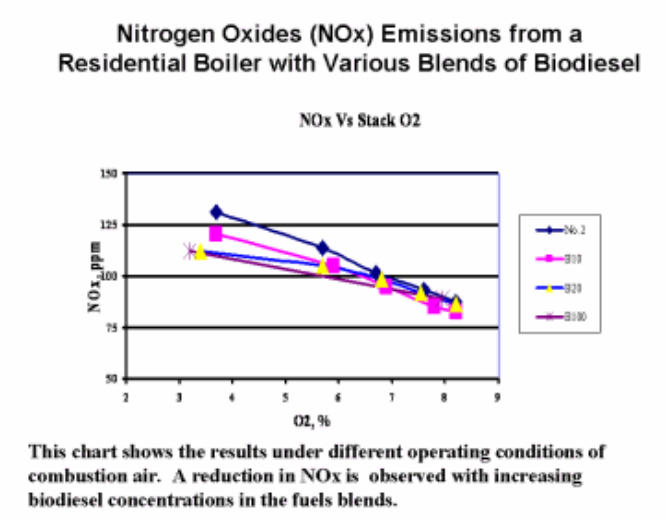
Environmental Benefits

A number of studies, including those performed by the federal government, have confirmed that biodiesel/biofuel matches the performance of petroleum diesel while also benefiting the environment and public health.[39] Biofuel proponents argue that biofuels have the potential to improve air quality, combat climate change and decrease lung disease. According to the DOE, biodiesel production and use, compared to petroleum diesel, produces 78 percent less carbon dioxide emissions. B20 reduces particulate matter and carbon monoxide by about 10 percent and lowers hydrocarbons (including some toxic air pollutants) by more than 20 percent. The actual net reductions depend on a variety of factors, including how the biofuel is produced, whether land was cleared to grow crops or wood, how much petroleum is used to grow, harvest and process feedstock and distance the feedstock and fuel is transported and distributed.[40]

Brookhaven National Laboratory and other researchers have reported significant environmental benefits with biofuel-blended heating oil. Combustion tests indicate that such blends can lower nitrogen oxide (NOx) emissions from residential oil burners by 10 to 20 percent compared to conventional fuel oil. Sulfur oxides (SOx) also are substantially lowered because biodiesel does not contain sulfur components.[41] See Figure 13 for nitrogen oxides reductions.

[39] National Biodiesel Board
[40] Rockefeller, pp. 9-10
[41] Brookhaven National Laboratory

Figure 13 – NOx Emissions Based on Biofuel Blends in Residential Boiler



Source: Brookhaven National Laboratory, http://www.bnl.gov/est/erd/biofuel/bnl.asp

With a net reduction in the release of carbon dioxide from production to end-use, greenhouse-gas emissions are also reduced. According to MEMA, "a robust residential liquid fuels program could reduce residential heating oil's carbon footprint in 2020 by over 20% and by over 40% in 2030."[42] Compared to conventional petroleum diesel, biodiesel can reduce particulate matter by 32 percent; carbon monoxide by 35 percent; and sulfur dioxide by 8 percent (on a life cycle basis).[43]

Supporters of biofuels and biomass also contend that private forest landowners will have incentives to ensure long term forest management with increased use of biofuels, as farmers will see new value in acres that are marginal for food production but compatible with energy crop planting and harvest. This will have the effect of further mitigating greenhouse gas emissions and pollutants from fuel oil.[44]

Economic Benefits

Direct economic development opportunities are a major driver in Maine and other states as they consider policies to expand biofuels production and use. The potential to create jobs and generate income and tax revenue throughout the entire biofuels chain is enticing:

[42] Py, Jan. 22, 2010
[43] Maine Forest Service, Sept. 2007)
[44] National Biomass Thermal Energy Council

- Growing and harvesting biofuels feedstocks;
- Construction, operation and maintenance of biofuels facilities; and
- Transportation of feedstocks and biofuels.[45]

Because biofuel resources could someday be obtained regularly from Maine's vast forest base, the State's extensive rural communities may particularly benefit from policies intended to increase demand for woody biomass feedstock. For example, as part of the *Food, Conservation and Energy Act of 2008* (P.L. 110-246), the U.S. Department of Agriculture created the Biomass Crop Assistance Program (BCAP) to "financially support the establishment and production of crops for conversion to bioenergy and to assist with collection, harvest, storage and transportation of eligible materials for use in a biomass conversion facility. BCAP provides payment to farmers while they establish and grow biomass crops in areas around biomass facilities."[46] In other words, forest land owners and operators growing eligible crops like trees and woody biomass feedstocks would get money for wood chips that go to biomass cogeneration facilities such as mills. Producers may receive payments of up to 75 percent of the cost of harvesting eligible crops for a time period of up to 15 years for woody perennial crops. BCAP also provides matching payments for the transportation to qualified biomass conversion facilities (including 26 in Maine) which convert the materials into heat, electricity and advanced biofuels. This policy is seen as an economic development policy as much as an energy security one. BCAP has provided more than $34.8 million in payments through 386 contracts with Maine growers and companies just during the past two years.[47]

[45] EPA, State Bioenergy Primer, p. 27
[46] Ibid, p. 28
[47] Leary

Research shows that economic benefits to the consumer can be gained from using blends of biofuels and home-heating oil. Since 1998, the Energy Resources Division at Brookhaven National Laboratory has conducted studies to assess the feasibility of using biofuel blends for home- and commercial-boilers. In one study sponsored by the National Renewable Energy Laboratory (NREL) and the Department of Energy (DOE), up to 30 percent of a biofuel could be blended readily with home heating oil and used in most appliances designed for use with home heating oil. The compatibility of the biofuel with the current heating system, the lack of need for retrofit and the increased efficiency of the furnace provided a cost-saving benefit to the homeowner.

An economic study carried on behalf of the Biotechnology Industry Organization (BIO) analyzed the impact of increasing U.S. advanced biofuels production to 21 billion gallons by 2022, roughly the amount called for in the *Energy Independence and Security Act of 2007* expansion of the federal renewable fuels standard for transportation. The study finds the following:

- Total job creation of 807,000 by 2022, with 190,000 directly derived from biofuels production.
- $12.2 billion in cumulative investments in advanced biofuels processing plants by 2022.
- $37 billion in direct economic output from advanced biofuels industry, including capital investment, research and development, feedstock production, biofuels distribution and other factors.
- Biomass feedstocks, including forest wastes and dedicated energy crops, of 470 million dry tons of biomass by 2030.[48]

As with energy and environmental benefits, supporters present a very positive economic picture that an increased supply of biomass and biofuel technologies for residential,

[48] bio-era, pp. 1-2

commercial and industrial heating purposes will create thousands of northeastern jobs and generate billions in economic activity.[49] However, we must contend with the cost issues for the State and residential and business consumers. While costs vary by location, a B20 blend generally can cost from 10-20 cents per gallon more than regular diesel fuel. The difference between B5 and regular number 2 heating oil has usually stayed at or under 5 cents per gallon. But, biodiesel is being used in every state in New England and increased demand for woody biomass could increase returns to landowners and loggers, generate employment, and if technologies for converting wood to number 2 heating oil prove financially feasible, there is a potential for stimulating new investment in Maine.

[49] Northeast Biomass Thermal Energy Council

This page intentionally left blank.

Biofuels Policies

National Biofuels Policies

Because of high and volatile fossil fuel prices and impacts of conventional energy uses on the environment, the United States considers renewable electricity generation and production of renewable transportation fuels high priorities. The U.S. military is also engaged in research and development of advanced biofuels, as the domestic dependence on foreign sources of oil is a major national security issue. A variety of federal policy tools are available to promote biomass and biofuels, including mandates, research and development programs and incentives.

Transportation

The *Energy Policy Act of 2005* (EPAct, P.L. 109-58) established a renewable fuels standard (RFS) that mandated minimum use volumes of biofuels in the national transportation fuel supply. This is the primary federal policy tool for transportation which, in addition to setting an annual goal for renewable fuels sold, contains provisions allowing refiners, blenders and importers to trade or purchase "credits" to meet the overall volume requirements.[50] (Rockefeller 32).

[50] Rockefeller, p. 32

The *Energy Independence and Security Act of 2007* (EISA, P.L. 110-140) expanded the RFS from 9 billion gallons in 2008 to 36 billion gallons in 2022, with special carve-outs for advanced biofuels (*i.e.*, non-corn-starch ethanol), cellulosic biofuels and biodiesel. The commodity price spikes of mid-2008 illustrated the potential conflict associated with conversion of domestic food crops to biofuels. In an attempt to shift biofuels policy distortions away from the food and feed supply markets, the EISA and the 2008 farm bill shifted biofuels research and development emphasis to cellulosic biofuels, since they can potentially be produced from non-food feedstocks such as crop residues, dedicated energy crops and woody biomass. In February 2010, the EPA issued rules for implementing the RFS and included mandatory reductions in life-cycle greenhouse gas emissions for each biofuels category, and restrictions on (Yacobucci).

Tax incentives have helped, to a certain extent, offset the cost differential between biodiesel and regular diesel. Under federal law, there have been several tax credits available to biodiesel blenders and producers. For blenders, one type of credit amounts to one penny per percentage point of biodiesel made from first-use oils (such as soybean oil) and a half-penny per percentage of biodiesel made from other sources (such as recycled cooking oil). In other words, an excise tax credit of $1 per gallon is offered to certified biodiesel blenders of refined B100 biodiesel. Blenders can pass these cost savings to consumers through competitive pricing practices.

Tax credits created through EPAct 2005 provided different incentives for using biodiesel: 1) an Alternative Fuel Refueling Infrastructure Tax Credit offered a credit for up to 30 percent of the installation cost for fueling stations that offer a range of alternative fuels, including biodiesel blended to B20 or higher; and a Small Agri-Biodiesel Producer Tax Credit gave a 10 cent per gallon credit, up to 15 million gallons, to producers of agri-biodiesel whose production capacity is less than 60 million gallons.[51] *The Tax Relief and Job Creation Act of 2010* extended a number of biofuels tax credits including:

- $1 per gallon tax credits for the production of biodiesel and diesel fuel made from biomass;
- $0.50 per gallon credit for blending alternative fuels (including ethanol and biodiesel);
- $0.10 per gallon small agri-biofuel (ethanol and diesel) producer credit; and
- $0.45 per gallon tax credit for ethanol.

These credits are set to expire on December 31, 2011.[52]

[51] EPA, *Biodiesel in New England*
[52] Maine Clean Communities

Electricity

On the electricity side, state renewable portfolio standards requiring utilities to gradually increase the portion of electricity produced from renewable resources exist in 28 states (including Maine) and the District of Columbia. A legislative effort to enact a national RPS is underway to complement the state RPSs currently covering 40 percent of the nation's electrical load. Some are concerned that not all states, particularly those in the Southeast, have sufficient renewable resources to satisfy a national RPS.

According to the Environmental and Energy Study Institute, "bioenergy was the largest component of renewable electricity production in the nation, comprising 56 percent of all renewable electricity and 1.3 percent of total electricity. This percentage can be increased significantly since each state has important biomass resources that can be utilized sustainably to produce clean, renewable, domestic energy." According to the EIA analysis, biomass generation—from dedicated biomass plants and existing coal plants co-firing with biomass fuel—grows the most by 2030, more than tripling from 102 billion kilowatt-hours (kwh) in the reference case to 318 billion kwh with the RPS policy.[53] "Renewable biomass harvested from sustainably managed forests has the potential to be an important contributor to a national RES [renewable energy standard], complementing other forms of renewable power and forming part of a robust, holistic strategy for addressing climate change and building a sustainable, clean energy economy."[54] Biomass facilities are also eligible for funding under renewable electricity generation incentives such as the production tax credits, an investment tax credit, modified accelerated cost recovery systems and clean energy renewable bonds.

Heat/Thermal

A third area of energy use – thermal applications for heating and cooling – has not been a federal energy priority compared to transportation and electricity applications.[55] To date, national renewable energy policies have ignored thermal energy and focused on electric generation and transportation fuels. While these policies are important, the concentration on only two of the three major applications for biomass and biofuels diminishes the energy potential of the nation's wood resources.[56]

State & Regional Biofuels Policies

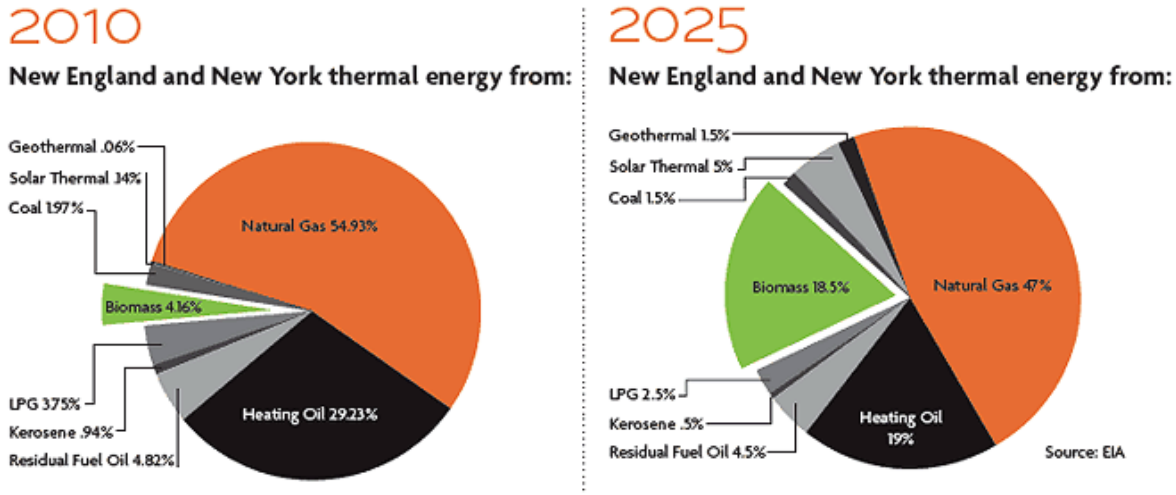
The Northeast Biomass Thermal Working Group presents a very vivid and hopeful case

[53] Environmental and Energy Studies Institute
[54] Ibid
[55] Manomet, p. 13, pp. 115-118
[56] Biomass Energy Resource Center

that, with the right policies in place:

- 19 million green tons of biomass would be available annually by 2025 for thermal energy applications in the Northeast;
- 25 percent of thermal energy from renewable resources by 2025;
- 75 percent of renewable energy from biomass by 2025;
- 1.38 million households converting to biomass for thermal needs;
- 1.14 billion gallons for heating oil reduced annually;
- $4.5 billion injected into the northeastern economy and 140,200 jobs created.

Figure 14 – Heating the Northeast with Renewable Biomass: A Bold Vision for 2025



Source: Northeast Biomass Thermal Working Group, ***www.nebioheat.org***.

Maine Biofuels Policies

Maine would certainly like to see this scenario materialize and, over the last decade, has explored and implemented various incentives, laws, regulations, funding opportunities, and other initiatives for alternative fuels as they relate to vehicles, advanced technologies, or air quality standards to varying degrees of success:

- ***Biofuels Production Tax Credit*** – A certified producer of ethanol, biodiesel, hydrogen, or methanol derived from biomass is allowed an income tax credit of $0.05 per gallon for the commercial production of biofuels for use in motor vehicles or otherwise used as a substitute for liquid fuels. For biofuels blended with petroleum or other non-biofuels, the credit is allowed only on the biofuels portion of that blend. Any portion of unused credits may be carried over for up to

10 taxable years. (Maine Revised Statutes Title 36, Section 5219-X). The tax credit appeared to be insufficient to overcome cost barriers.[57]

- ***Biodiesel Fuel Tax Exemption*** – Biodiesel fuel that is produced by an individual and used by that same individual or a member of that individual's immediate family is exempt from the state fuel excise tax. (Maine Revised Statutes Title 36, Section 3204-A).
- ***Low Emission Vehicle (LEV) Standards*** – Maine adopted the California motor vehicle emissions standards specified in Title 13 of the California Code of Regulations. These regulations apply to all passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty diesel vehicles and engines. Manufacturers must meet the greenhouse gas emissions standard and the zero emissions vehicle sales requirement. (Department of Environmental Protection Rules, Chapter 127).
- **Fuel Tax Equalization for Clean Fuels in Maine.** Beginning October 1, 2000 the State Highway Tax on clean fuels was equalized to gasoline according to their relative energy (BTU) content by volume. In 2008 adjustments were made and some fuels were added. Beginning July, 2009 ethanol and biodiesel blends up to 90% are taxed at gasoline and diesel rates, respectively. All fuels are subject to annual indexing relative to the petroleum product they displace.

Fuel Type	BTU content per gallon	Formula (BTU value fuel/BTU value gasoline)	Tax Rate
Gasoline	115,000	100% x $0.295	$0.295 per gallon
Methanol (M85)	56,800	49% x $0.295	$0.145 per gallon
Ethanol (E85)	76,800	66% x $0.295	$0.195 per gallon
Propane (LPG)	84,500	73% x $0.295	$0.215 per gallon
Compressed Natural Gas (CNG)	115,000*	100% x $0.295	$0.295 per GGE**
Hydrogen	115,000*	100% x $0.295	$0.295 per GGE**
HCNG***	115,000*	100% x $0.295	$0.295 per GGE**
Diesel	128,400	100% x $0.307	$0.307 per gallon
Natural Gas (LNG)***	73,500	57% x $0.307	$0.175 per gallon
BioDiesel (B100)	118,300	100% x $0.307	$0.282 per gallon

*BTU per gasoline gallon equivalent (GGE)
** Hydrogen Compressed Natural Gas*** Liquefied Natural Gas

Source: Greater Portland Council of Governments, Maine Clean Communities, www.mainecleancommunities.gpcog.info/incentives

- ***Fuel Efficient Vehicle Acquisition Requirements*** – The Maine State Purchasing Agent may not purchase or lease any car or light-duty truck for use by the state or any department or agency of the state unless the car has a manufacturer's estimated highway mileage rating of at least 45 miles per gallon and the light-duty

[57] Rockefeller, p. 27

truck has a manufacturer's estimated highway mileage rating of at least 35 miles per gallon. (Maine Revised Statutes Title 5, Section 1812-E).

- ***Transportation Efficiency Fund*** – A non-lapsing fund managed by the Department of Transportation to increase energy efficiency and reduce reliance on fossil fuels within the state's transportation system. Funding may be used for zero-emission vehicles, biofuel and other alternative fuel vehicles, congestion mitigation and air quality initiatives, rail, public transit, and car or van pooling. (Maine Revised Statutes Title 23, Section 4210-E).
- ***Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans*** – The Finance Authority of Maine manages the Clean Fuel Vehicle Fund, a non-lapsing revolving loan fund, which may be used for direct loans and grants to support production, distribution and consumption of clean fuels and biofuels. FAME may also insure up to 100% of mortgage payments with respect to mortgage loans for clean fuel vehicle projects. (Maine Revised Statutes Title 10, Sections 1023-K and 1026-A). The program has been of little use because of insufficient funding.

State Biofuels Policies

Many of the largest biofuel-producing and consuming states, including Minnesota and Iowa, have some version of the RFS. Iowa's RFS is unique in that it is based on incentives rather than a mandate. Fuel dealers receive incentives based on how close they come to meeting a percentage blend. Minnesota has a straight mandate, requiring 2 percent biodiesel in all diesel and 10 percent ethanol in all gasoline.[58] The RFS in Oregon and Louisiana can be triggered when instate production reaches a predetermined level. This type of RFS directly affects production and ensures economic benefits. It could also be triggered on a regional basis – designed to go into effect when another state passes the RFS. This might allay some concerns about the size of Maine's market.[59]

Massachusetts was the first state to mandate the use of advanced biofuels in both home heating oil and on-road diesel fuel. In 2006, the Commonwealth began requiring a minimum percentage of biofuels in state vehicles and started a pilot program to examine biofuels in state building heating systems. In 2008, the *Clean Energy Biofuels Act* was signed by the Governor which exempted cellulosic biofuels from the state gasoline tax; required transportation diesel and home heating oil to contain 2 – 5 percent cellulosic biofuels from 2010 – 2013; and required development of a low carbon fuel standard to reduce transportation greenhouse gas emissions by 10 percent.[60]

Although the Massachusetts heating oil mandate was suspended prior to its July 1, 2010 start-date due to cost concerns, many retailers throughout the Commonwealth are already

[58] Rockefeller, p. 45
[59] Ibid
[60] Manomet, p. 120

selling biofuel and the Massachusetts Oilheat Council estimates that when the Massachusetts biofuels mandate is fully operational, the state will reduce petroleum use by over 40 million gallons annually.[61] The Massachusetts law required all home heating oil to include at least a two percent blend of biofuel by July 1, 2010, increasing to five percent in 2013. In comparison, the original version of LD 1632 applied a "trigger" approach with the following percentages, production level requirements and timetables:

- Beginning July 1, 2011, a person may not sell number 2 heating oil for use in the State unless it contains at least 2% biofuel.
- After the first calendar year in which annual production of biofuel in the State is at least 20,000,000 gallons, a person may not sell number 2 heating oil for use in the State unless it contains at least 5% biofuel.
- After the first calendar year in which annual production of biofuel in the State is at least 40,000,000 gallons, a person may not sell number 2 heating oil for use in the State unless it contains at least 10% biofuel.

Under the original version of LD 1632, if the price of number 2 heating oil meeting the biofuel requirement exceeded by 20 percent or more the price of number 2 heating oil that did not meet the biofuel requirement, the Governor had the authority to issue a waiver of the biofuel requirement. The Massachusetts law has a similar waiver requirement. We will discuss the Massachusetts experience in more detail in the next section.

Minnesota enacted a law in 2009 mandating an increase from 2 percent (B2) to a five percent (B5) biodiesel blend in transportation fuels with a goal to require B20 by 2015. Minnesota estimates that B5 will prevent 139 tons of particulate matter and 330,000 tons of (lifecycle) greenhouse gas emission annually, the equivalent of taking more than 55,000 cars off the road each year. Other states, including Washington, Oregon, Pennsylvania, Louisiana and New Mexico have enacted similar standards.[62] In 2009, Minnesota temporarily waived the requirement for #1 diesel fuel to be blended with 5 percent biodiesel in response to concerns from the Minnesota Biodiesel Council and the Minnesota Petroleum Marketers Association that the mix could lead to clogged filters in extreme cold weather.

In Connecticut, the state DOT has been using B20 for years. In June 2010, Connecticut enacted a law requiring all heating oil sold in the state to contain at least 2 percent biodiesel by July 1, 2011, replacing 100 million gallons of traditional petroleum fuels. However, a provision in the bill holds off final implementation of the requirements until Massachusetts, New York and Rhode Island pass similar legislation. Massachusetts

[61] Massachusetts Oilheat Association
[62] Minnesota Department of Commerce

already has a 2 percent biodiesel requirement on the books, and mandate proposals are in the works in the New York and Rhode Island state legislatures.[63] New York City requires all grades of heating oil sold in the city to contain at least 2 percent biofuels starting in October 2012. The New York Oil Heating Association states that the 2012 date will provide oil dealers with enough time to upgrade their biodiesel distribution infrastructure and meet the mandate.[64]

[63] Independent Connecticut Petroleum Council
[64] Energy Communications Council

Feasibility of a Requirement for Biofuels in Number 2 Heating Oil

The Science

The National Biodiesel Board, the Department of Energy and its laboratory partners (NREL, Brookhaven), and the heating oil industry, including the National Oilheat Research Alliance (NORA), have been studying the feasibility of using biofuels in number 2 heating oil for years. For example, one study conducted on behalf of the oilheat industry found that "using B5 biodiesel blend fuels, components and/or heating appliances intended for use with No. 2 fuel oil, yielded acceptable results…"[65] Brookhaven cites that extensive field analyses shows that B5 is "established" as an appropriate blend in number 2 heating oil and that adopting biofuels in heating oil offers strong potential for reductions in petroleum use.[66] These researchers maintain that biofuels have been thoroughly tested in heating applications and that energy performance and efficiency and environmental benefits are real and verifiable.

The Infrastructure

The infrastructure to bring biofuels to customers also appears to be emerging. Currently, there are several suppliers of biodiesel, approximately 35 blenders and distributors of biodiesel and more than 50 biodiesel retail fueling stations throughout New England. Suppliers work with a network of distributors to provide biofuels to a variety of locations across the country and throughout the New England states.[67] In Maine, there is a question as to whether a mandate for biofuels in heating oil will have much of an effect on instate production and supply. According to one supplier of biofuels for heating, "until the next generation of biofuels from biomass is commercially viable, Maine may not be in a position to refine a competitively-priced biofuel." However, the same supplier commented that storage infrastructure may be relatively easy to put in place if a mandate were in effect, especially in the southern region of the state, as larger tanks may be all that is needed.

[65] Underwriters Laboratories, Inc.
[66] Butcher
[67] EPA, *Biodiesel in New England*

The Production and Distribution

Biofine Technology, operated out of Gorham, Maine, is one of the Maine leaders in developing an advanced biofuel for use in domestic heating oil applications. Biofine asserts that using a non-food feedstock derived from wood and wood waste, their product is a beneficial blend with heating oil and is capable of clean combustion and high efficiency and energy content. Like other biofuel producers, they are looking toward incentives that will ensure consistent and robust supply and demand in the heating sector.[68]

The Maine heating fuel industry has been generally supportive of biofuels and the use of wood wastes and other cellulosic material to produce liquid fuels. Additional production of biofuels in Maine would ensure an additional source of supply for the industry and position distributors as a key link between environmentally-beneficial, renewable, home-grown fuel and residential customers.

The New York Strategy

States continue to study and consider the feasibility of setting a biofuel requirement for heating fuels. New York considered a B2 mandate covering all end uses and a more limited mandate covering on-highway diesel uses and expanding to include residential, commercial, industrial and utility uses. [69] Their study led to a number of findings. First, New York can supply some but not all of the feedstock requirements for a statewide biodiesel industry, but the state's agricultural industry would be a major beneficiary of a mandate, much like Maine's forest industry could benefit from such a requirement. Second, a biofuel requirement would require distributors to make investments in infrastructure that would create economic benefits. Third, a biofuel incentive or policy should be phased in over time and be linked to a New York biofuel capacity to allow adequate time for the necessary capital investment for production and infrastructure to be made. Fourth, a B2 policy will attract investment, expand the State economy, generate additional income for New Yorkers, and will create new jobs. Fifth, a mandate would result in new investment and spending on bio production and infrastructure investment. Sixth, increased income and spending will generate additional tax revenue for the State. Finally, a mandate will result in increased fuel costs to individual businesses and consumers (and the State). The study was completed in 2004; in 2011, New York still has no heating fuel mandate.

[68] Fitzpatrick
[69] NYSERDA

The Maine Experience

The Maine Bureau of General Services (BGS), on behalf of executive branch departments and agencies, purchased approximately 500,000 gallons of B5 heating oil in Fiscal Year 2010. While supportive of biofuel blends in state facility heating systems, to date, biofuel has been priced at a premium compared with number 2 oil. The premium paid by the State of Maine itself since 2007 has varied depending on market conditions from $.01 to $.20. The experience at BGS has been that B5 implies no material infrastructure changes in its facilities. Blends with a greater proportion of biofuel components (*i.e.*, B20) have been problematic in the past. Maine also has piloted but not continued the use of other biofuels, such as biomass, which tend to require more substantial change and more attention to infrastructure.

According to Alan Henry at BGS, "the use of blended biofuels brings greater energy independence to state facilities, reduces our reliance and expenditures on imported foreign oil and reduces the State's own carbon footprint. Maine's use of biooil currently reduces the State's carbon emissions by approximately 3 percent annually. To date, this has come at a cost premium of less than 1 percent to as much as nearly 10 percent per gallon." The use of biofuels in state buildings also fulfills the Maine Comprehensive Energy Action Plan mission to "lead by example" as an early adopter and institutional-scale consumer of biofuels.

A legislative proposal or legal requirement to purchase biofuels or mandate that only heating oil with biofuels be sold in the State of Maine would seem to require a fiscal impact statement because of the impact such a requirement would impose on the state budget. While the state has been successful in meeting a portion of its heating oil need with biofuels with available and approved funding resources, a requirement to do this would trigger a fiscal note. For every one cent difference between the cost of biofuel and number 2 heating oil, the estimated fiscal impact to the state budget if a requirement existed would be approximately $28,000 annually if the requirement applied to all heating oil used by state government. The actual and estimated impact would of course depend on the exact language of any such proposed requirement. The estimated cost impact of $28,000 per penny is based on the cost of fuel only, and does not account for

any infrastructure changes, licensing or staff issues that may be associated with fuel switching.[70]

Despite the energy, environmental and economic benefits of setting a requirement for a percentage of biofuels to be used in number 2 heating oil, one of the immediate implications of requiring blended heating oil in Maine would seem to be increased costs for consumers. The original version of LD 1632 set a requirement that, beginning in July 2011, all number 2 home heating oil sold in Maine would be required to contain 2 percent biofuel. As certain targets for biofuel produced in Maine were met, the required percentage would increase, capping out at 10 percent once 40 million gallons per year were being produced. The bill contained a clause allowing the Governor to suspend the mandate if the cost of fuel rises more than 20 percent above market price for number 2 oil.

In considering feasibility of a mandate in Maine, it is important to note the recent Massachusetts experience, but with the understanding that the two states differ in their biofuel resources.

The Massachusetts Experience

As discussed above, Massachusetts enacted a law requiring a blend of biofuels in home heating oil to be effective July 1, 2010. On June 30, 2010, the Massachusetts Department of Energy Resources announced a delay in implementation due to cost concerns.

- *It is the finding of DOER that implementing a minimum biofuel content requirement in diesel transportation fuel and heating fuel is not feasible on the basis of unreasonable cost and will instead move forward with a voluntary program to encourage the use of biofuels that meets the standards of the Clean Energy Biofuels Act…*
- *The cost of compliance with the program would significantly burden all fuel companies and the cost will largely be passed on to consumers…*
- *Additional costs associated with the mandate (infrastructure upgrades, specialty blending, and administrative costs for compliance) would add substantially to the net increase in costs to the fuels industry and fuel prices to consumers."*

Massachusetts also found that the January 1, 2010 expiration of the federal $1.00 per gallon biofuel blender credit would also result in a cost increase and the credit was subsequently extended retroactively. In addition to cost issues and expiration of the federal credit, the logistics of how to implement the law appears to play a role in the

[70] Maine Bureau of General Services

decision. The new voluntary program allows, but does not require, the heating oil and diesel industry to report their usage to the DOER to gather information for a possible future mandate.[71]

Reactions to the DOER suspension from the heating oil industry were cautious but supportive. The National Biodiesel Board and other groups responded to the suspension by recognizing that the majority of states, especially the Northeast, were very committed to biofuels and would continue to be so with or without a mandate.[72] In fact, just a few months earlier a gathering of oilheat leaders, including the National Oilheat Research Alliance, New England Fuel Institute and Petroleum Marketers Association of America had approved a resolution calling for all heating oil to be mixed with a 2 percent biofuel component by July 2010 (the same time as the Massachusetts law was to go into effect) with goals to increase levels gradually over time.[73] According to the NBB, the Bioheat market, at a 5 percent blend, has the potential to increase demand for biodiesel by 450 million gallons annually. The group recognized the thorough research conducted by nationally recognized institutions such as the Brookhaven National Laboratory, US Department of Energy's National Renewable Energy Lab, Massachusetts Oil Heat Council, Abbott & Mills Oil Company, NOCO, New York State Energy Research and Development Authority, (NYSERDA) and NORA demonstrated that "blending home heating fuel with biodiesel, Bioheat fuel, is seamless and transparent to the heating oil network and works in home and commercial heating systems with no adverse operational characteristics."

Others believe that an industry commitment to biofuels in heating oil is dependent on a regulatory mandate. According to an article in the January 2011 *Biodiesel Magazine*:

> *Ed Burke with the Chelsea, Mass.-based Burke Oil says he's heard that many states will hop on the mandate wagon as soon as three other states implement one. In an area such as the Northeast, which is geographically compact yet densely populated, this is an important concept. Townsend* [*added by OEIS*, Jim Townsend of Massachusetts-based Townsend Oil & Propane] *says Massachusetts oil dealers can pick up fuel in New Hampshire, Rhode Island, Connecticut or New York, so if any one of those supply points does not have the available mandated fuel (e.g., B2 heating oil), this could mean trouble logistically. "We would need the [Massachusetts] mandated fuel available outside of Massachusetts,¨ Townsend says. Cota elaborates on this by saying, "We all have our own issues local and state but we cannot be an island, especially in Vermont, because then we can't go out to Massachusetts or New York to receive fuel. We all have to have similar standards. In Vermont, we have 140,000 oilheat customers who use 100*

[71] Massachusetts DOER
[72] Voegele
[73] National Biodiesel Board, Sept. 21, 2009

MMgy of heating oil. If we created specs or standards that are different than others, it would be foolish.¨ He says that the likelihood of any mandates in the Northeast being passed by July 2010 is slim to none, except for Massachusetts, which already has one in place and a contentious one, at that. The Massachusetts law, as we know, was suspended later that year.[74] (Kotrba).

The Canadian Plan

Leading the way on biofuels, the Canadian government announced in February 2011 their intention to require a B2 blend in all diesel and heating oil and a 5 percent renewable content in gasoline sold in Canada by July 2011. The Renewable Fuels Regulations will apply to all producers and importers of diesel fuels and heating oil and are expected to reduce annual greenhouse gas emission by 4 million metric tons, equivalent to removing 1 million vehicles from Canadian roads. The National Renewable Diesel Demonstration Initiative studied the 2 percent mandate and found it to be technically feasible. However, the Natural Resources Canada also found that the industry may need one to three years lead-time to make infrastructure changes necessary to accommodate blending of biofuels and other renewable content into heating and diesel fuels.

[74] Kotrba

Conclusion and Recommendations

Pursuant to *Resolve Chapter 210 (LD 1632) – Regarding Biofuel in Number 2 Heating Oil,* the Governor's Office of Energy Independence and Security (OEIS) was required to "oversee a study of the energy, environmental and economic feasibility of setting a requirement for the percentage of biofuel to be used in number 2 heating oil." The OEIS approached this task with an eye toward identifying, evaluating and promoting the economically advantageous use and development of alternative fuels within the context of capitalizing on Maine resources and controlling costs to Maine homeowners.

Recommendations are based on the economic, environment and energy benefits and barriers of requiring biofuels in heating oil, including the important considerations of containing energy costs, reducing reliance on imported oil, developing and preserving market-based competitive pricing and protecting the environment. The balance between encouraging Maine's energy resources and securing price stability should be encouraged. The OEIS believes that the Maine biofuels industry will grow based on market demand among consumers rather than a specific requirement for biofuel production. However, we must take steps to facilitate the biofuels industry in Maine to meet potential consumer demand.

Conclusion

Maine has important interests and goals to warrant serious consideration of a percentage of biofuels in number 2 heating oil – to promote indigenous renewable resources, to reduce air pollution and greenhouse gas emissions, to enhance industries and create jobs, and to reduce dependence on volatile foreign sources of oil. The market for biofuels looks promising in Maine – the State has an emerging biofuels industry and significant biomass resources in the forest industry to further support biofuels development. Energy prices for heating oil, propane, and kerosene and, to a lesser extent, natural gas are unpredictable and unstable. The cost of energy (*e.g.*, heating oil, natural gas, propane) is projected to increase. While a variety of public policies are available to encourage biofuel production, supply and demand, requiring a blend of biofuels with petroleum-based fuels could be an effective strategy.[75]

The testimony of the Maine Energy Marketers Association (MEMA) during the 124th Maine Legislature Committee on Natural Resources hearings and work sessions on LD 1632 was compelling and supported the benefits and feasibility examination and analysis throughout this report. David Martin, Board Chairman of MEMA testified that:

[75] Morgan, pp. 16-17

"a 2% or 5% or even a 10% bio-blend and you have made significant advances in curbing the energy needs of Maine citizens derived from foreign oil. This coupled with the fact that the potential for bio-blend stock, grown, harvested and refined in Maine by Maine people for Maine people is close to a reality you can and should get pretty excited."

Jamie Py, President of MEMA submitted testimony with the following persuasive points:

- "B-5 ULSD (ultra-low-sulfur diesel) blends have been proven by Brookhaven National Labs to be completely compatible with all existing heating oil systems.
- As the only fossil fuel moving toward renewability, the 2% biofuel mandate, an ASTM standard only product, will reduce our reliance on foreign oil and spur economic development in this state and the US in general.
- A requirement for bio-fuel can encourage private enterprise to co-locate biofuels manufacturers within our state as processes for making biofuels can co-locate with and take advantage of the assets at existing mills in Maine.
- Today's first generation bio-fuels generally reduce greenhouse gas emissions directly proportional to their use with some consideration for production emissions. The possibilities of the next generation of biofuels are fantastic.
- Cleaner heat exchangers promote better efficiency of the boiler/furnace producing savings in fuel usage and the subsequent reduction in emissions.
- Biofuels and ULSD can be used in existing homes and businesses using existing infrastructure. No need to spend billions on the delivery infrastructure, plus there are already 8,000 Maine citizens making a good wage working in it.
- BNL and other research groups reporting significant environmental benefits with biodiesel-blended fuels. Combustion tests indicate that such blends can lower nitrogen-oxide emissions from residential oil burners by 10 percent to 20 percent compared to conventional fuel oil. Sulfur oxides are also substantially lowered because biodiesel does not contain sulfur components. With a net reduction in the release of carbon dioxide from production to end-use, greenhouse gas emissions are also reduced."

A biofuels blend requirement is intended to ensure a steady, predictable market. But, market forces are already likely to drive consumers toward the increased use of biofuels and other forms of biomass for heating applications. And, ongoing federal and regional initiative developments and implementation, such as the final national renewable fuels standard and the developing low carbon fuel standard in the northeast, are regulatory factors that may influence the biofuels market in New England.

Overshadowing all regulatory policy, on both the national and state levels, is the continuing recession which has left Maine and other states with large budget shortfalls. Even as the economy appears to be moving in the direction of recovery at the time of the

writing of this report, fiscal conditions may remain weak for some time. Federal assistance and grants through the *American Recovery and Reinvestment Act* will come to an end in the current fiscal year. Potential sustained high unemployment may keep state tax receipts at relatively low levels and increase demand for essential services that states provide. Economic uncertainty, combined with households' diminished wealth and property values, may continue to depress consumption. Housing markets may be slow to recover. Heating oil and other energy prices will likely remain volatile in the face of swings in geopolitical events, crude oil inventory levels and global demand for petroleum products, especially in developing countries like China.

However, if biofuels can become cost competitive with number 2 heating oil, demand will increase and production may follow. State or regional renewable or low-carbon fuel standards, as well as financial incentives, should be examined in a manner that promotes and advances cost-competitive, reasonably priced sources of heat for Maine's homes and businesses.

Recommendations

The Governor's Office of Energy Independence and Security (OEIS) supports the goals of LD 1632 and believes incentives for biofuels to be used in number 2 heating oil should be examined in future state policy. However, the OEIS must make recommendations in the context of the feasibility of all components of a sound energy policy – energy security, competitively-priced resources, job creation, environmental protection and economic development. As the 2008 OEIS report on "Liquid Biofuels Policy in Maine" reveals, "it is difficult to promote all three 'E's" – economic development, energy independence and the environment – through a single policy." The biofuels industry is likely to grow based on demand from consumers rather than a government mandate.

Based on the feasibility of linking annual production of biofuel in the State to use goals and requirements; consideration of supply, price and infrastructure issues for number 2 heating oil; consideration of federal regulations, programs and legislative proposals; policies in other states; and the State of Maine Comprehensive Energy Action Plan, the OEIS recommends the following.

1. *The Maine Legislature and the Governor should continue to explore whether a percentage of biofuels to be used in number 2 heating oil should be a state policy, particularly at a time when policymakers are more confident in the State's economic conditions and circumstances, and consumers' ability to financially absorb a potential price increase for biofuel-blended heating fuel.*

   The United States and the State of Maine are emerging from the worst recessionary period since the 1930's, unemployment is high, job creation and

retention remains sluggish and Maine residents are concerned about their health care and energy costs more than ever. "Timing" is crucial in developing and implementing regulatory requirements. The OEIS cannot, nor should it, attempt to predict the economic outlook for Maine residents and businesses, but it must take into consideration the economic implications of its recommended energy policy.

The OEIS maintains that incentives or requirements for heating oil to contain a certain percentage of biofuel may be an effective state-level policy for increasing biofuels production, distribution and consumption. The OEIS also supports the contention that instate production of biofuels should be a factor as to whether a requirement is needed or whether the market should be allowed to dictate the amount of biofuels in heating oil. Any biofuels policy should be phased in over time and should be linked to biodiesel production in Maine to allow time for the adequate capital investment for production and infrastructure to be made. A renewable fuels policy could result in direct energy security benefits by reducing petroleum consumption, environmental benefits by reducing air pollution and greenhouse gas emissions and economic benefits by stimulating the forest products industry in Maine and creating long-term "green" jobs. The Legislature and Governor, on an annual basis, should reassess the energy, environmental and economic need and feasibility of a biofuels standard for heating oil.

2. *The Governor's Office of Energy Independence and Security (OEIS), in coordination with the Department of Environmental Protection and Maine Forest Service, should develop an information database of biomass and biofuel production, capacity, supply, price and consumption resources in Maine.*

Under LD 1632, the performance of the study's examination of supply goals and requirements and price considerations under subsection 1 was dependent on receipt of funding through a 3rd-party grant or donation. While this report touches upon all of these areas, the OEIS did not receive this funding assistance. It is unclear how much wood and other feedstock is available for use in biofuels and at what cost it can be brought to market. There is also no coordinated and up-to-date outreach and clearinghouse for this information. The petroleum and biofuels markets are complicated and compliance tracking and price issues are not well documented. Any sound biofuels energy policy must be based on complete, concise and comprehensive information.

The OEIS should work with primary petroleum storage facilities and suppliers, heating oil distributors, independent biofuel producers and suppliers, the Department of Environmental Protection, Maine Forest Agency and Efficiency Maine Trust, USDA representatives, universities as well as the forest products

industry to acquire this data in order to provide a solid foundation for biofuels policy in Maine. The OEIS should also assume the primary responsibility to identify biofuels projects in need of assistance, track federal legislation, regulations, programs and incentives related to biofuels and communicate with biofuels stakeholders. This two-way communication and information sharing is critical to Maine's support and promotion of the biofuels industry.

A complete inventory of its biomass feedstocks will allow Maine to fully assess the range of options for biofuel policy and development. The total fuel potential in Maine is necessary to ensure the most technically and economically viable incentives for production and use. The ability to assess feedstock types (*i.e.*, wood), geography (economic development in rural areas) and energy resources is vital to this effort.

Photo: Portland Press Herald

Energy planning involves a strategic effort to develop goals and objectives based on good information to formulate policies.

3. *The Maine Department of Environmental Protection should continue to explore a cost-effective regional low carbon fuel standard that includes biofuels as a component.*

In December 2009, eleven Northeast and Mid-Atlantic states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont) signed a memorandum of understanding committing to a collaborative examination of a regional low carbon fuel standard (LCFS) and developing a proposed program framework by early 2011. The participating states conducted an in-depth analysis of the potential environmental and economic impacts of a regional LCFS to develop a fuel neutral, market-based program designed to reduce greenhouse gas emissions by lowering the average carbon intensity of transportation fuels used in the region over time. Carbon intensity is a measure of the amount of greenhouse gases released throughout a fuel's full lifecycle – including extraction, production,

transport and combustion – per unit of energy produced. This program allows diverse fuels to compare and compete based on their climate change impacts.[76]

As conceived, the LCFS will require suppliers of gasoline and diesel to reduce the average carbon content of the fuel they deliver for sale in the region over time. Producers and distributors of low carbon fuels, such as liquid biofuels, natural gas and hydrogen, will be allowed to voluntarily opt-in to the program and sell low-carbon credits to gasoline and diesel fuel suppliers to achieve the programs targets. The market is expected to create competition among producers, leading to technological innovation and lower prices.

At this time, number 2 distillate heating oil would be included in the program, but will be assigned a separate reference carbon intensity score and a zero-reduction "no backsliding" target at the outset. This is intended to reduce the likelihood that heating oil becomes a "dumping ground" for high carbon intensity diesel products. Approved low carbon liquid fuels like biofuels used in the heating sector may be eligible for credit generation to meet transportation diesel carbon intensity reduction requirements.[77]

The OEIS supports the inclusion of heating oil in the development of an LCFS and recommends its continued role in the framework document and subsequent Maine legislation and DEP rulemaking. If a LCFS is developed on a regional basis, it could spur new biofuels business opportunities in Maine's wood and other feedstock markets, reduce petroleum consumption and protect Maine citizens from volatile fuel prices. Maine's biofuels market may be too small to handle a state-specific renewable fuels standard for heating oil, but a regional effort could provide an incentive to commercialize new biofuels, encourage the development of infrastructure to produce and distribute biofuels and provide

[76] Northeast and Mid-Atlantic Low Carbon Fuel Standard, Memorandum of Understanding
[77] Marin

opportunities to lower heating oil costs for Maine consumers. A properly structured regional LCFS may also help influence and shape the timing and composition of a Maine-specific policy for heating fuels. The inclusion of heating oil in the LCFS may also alleviate some concerns of the petroleum industry, which opposed mandating biofuel usage in heating oil in 2011 without reference to lifecycle analysis, a component that is vital to the regional LCFS.[78]

We must ensure that, if a LCFS covers heating fuels, that consumers are not likely to see an increase in the cost of heating their homes. Under current market conditions, biofuels are not as widely available as petroleum-based fuels and tend to have a price differential as compared to straight number 2 heating oil. "These potentially higher costs would likely be passed on to the consumer in the form of higher retail heating oil prices. However, a shift in the market (brought on by major increases in the price of crude oil, for example) could make biodiesel cheaper and more widely available, in which case increased biodiesel content in heating oil under a LCFS could actually result in lower heating oil prices."[79] Also, the nature of a large regional market for biofuels may keep prices lower than a lone state with a mandated biofuels mandate.

4. *The Governor's Office of Energy Independence and Security (OEIS) should advocate with the U.S. Department of Agriculture and Environmental Protection Agency to broaden the Renewable Fuels Standard to include focus on reducing reliance on #2 heating oil through use of biofuels – liquid, gaseous or solid (e.g., wood chips and pellets).*

The Energy Policy Act of 2005 established a renewable fuel standard that mandated minimum use volumes of biofuels in the national transportation fuel supply. *The Energy Independence and Security Act of 2007* greatly expanded the RFS with special carve-outs for advanced biofuels, cellulosic biofuels and biodiesel. Under the EISA, the cellulosic biofuels mandate grows quickly from 100 million gallons per year in 2010 to 16 billion gallons by 2022. In early 2010, cellulosic biofuels were being produced on a very small, non-commercial scale, making the mandates difficult to achieve. As a result, the EPA reduced the cellulosic biofuels RFS for 2010 and waivers are available to accommodate shortfalls in the biofuels industry cannot meet the RFS.[80]

The national RFS appears to help advance Maine's mission to develop and use clean, sustainable biofuels produced in the State while increasing and maintaining energy security, environmental quality and economic development. However,

[78] Quinn
[79] Garrett
[80] CRS, March 3, 2010

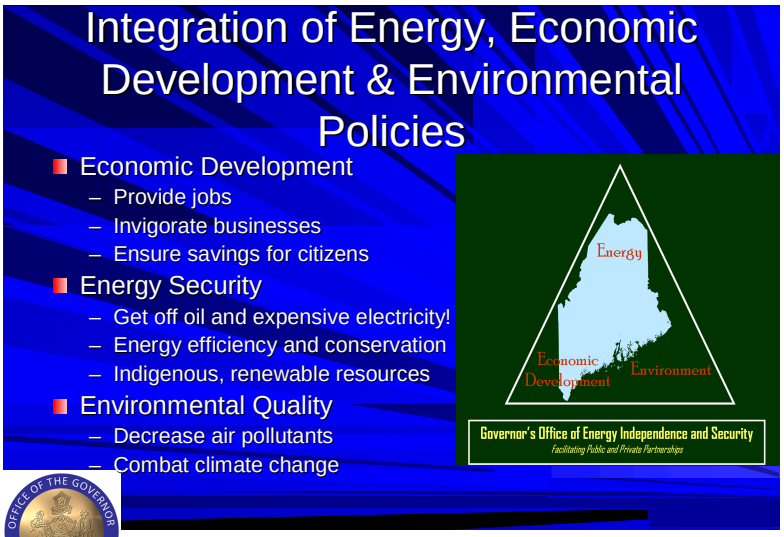
based on current and potential heating oil consumption and market conditions, and the RFS focus on producing and using 36 billion gallons of renewable *transportation* fuel per year by 2022, we feel that the RFS should provide incentives to produce and use biomass and biofuels for heating purposes.

As mentioned earlier, Maine is dependent on volatile imported oil to heat homes and businesses. More than half of Maine's energy consumption is through the use of foreign sources of petroleum, with approximately 1.6 billion gallons of petroleum consumed in 2008, including distillate fuels, motor gasoline and other petroleum products. Maine residences and businesses are about 75 percent dependent on oil for heating purposes, one of the highest per capita rates in the nation. The high percentage of households that use number 2 heating oil and the total reliance on petroleum for transportation needs drain dollars out of the State and essentially institute an estimated $5 billion "Petro-Dependence Tax" on ALL Maine citizens, business and industries (in 2008). Maine is already New England's largest renewable energy power producer with 20 percent of the region's biomass energy. Maine also has aggressive energy efficiency goals to weatherize all Maine residences and half of businesses by 2030 and achieve energy savings by 2020 of at least 30 percent of electric and natural gas consumption and 20 percent of heating fuels consumption.

To supplement these goals, we must support clean, renewable, home-grown fuels to heat Maine's businesses and homes. This report points out that biofuel used in heating oil could have energy, economic and environmental benefits for Maine consumers. Maine has the highest percentage of forest land in the country, nearly 90 percent, equating to over 17 million acres. Wood already provides 20 percent of electricity needs and 25 percent of the energy in Maine. The forest is the single largest contributor to Maine's economy with 5.7 billion dollars of direct annual product value employing nearly 32,000 people and providing the largest source of exports for the state economy. However, production of wood pellets and biofuels for residential heating needs to increase significantly over the coming decades to reduce our addiction to oil and help us approach energy security.

5. *The Bureau of General Services should continue to pursue the use of biofuels in state buildings and other facilities.*

The use of biofuels in state building heating systems fulfills the Maine Energy Plan to "lead by example" as an early adopter and institutional-scale consumer of biofuels. The BGS should continue to look for ways to increase the purchase of biofuels for state heating purposes, including in its solicitations for heating oil, as its budget allows.



Governor's Office of Energy Independence & Security

This page intentionally left blank.

Appendix A – Biofuels Stakeholder Questions

1. What is your organization's role in Maine's biofuels industry?
2. What is the current production level of biofuels in Maine for heating and transportation applications?
3. What is the feedstock used in the production of biofuels in Maine (e.g., agricultural crops and residues, forest products and by-products and separated food waste)?
4. What is the current consumption level of biofuels in Maine for heating and transportation applications?
5. What is the estimated total potential of instate biofuels production/supply if Maine requires a percentage of biofuels to be used in number 2 heating oil?
6. What is the timeline required to implement various percentages of biofuels in number 2 heating oil? For example:
    a. Feasibility of a goal of number 2 heating oil containing at least 2 percent biofuel beginning July 1, 2013;
    b. Feasibility of a goal of number 2 heating oil containing at least 5 percent biofuel beginning July 1, 2015.
7. What are the price implications for residential and business consumers for number 2 heating oil if Maine requires a percentage of biofuels to be used in the fuel?
8. What are the infrastructure needs and implications for number 2 heating oil if Maine requires a percentage of biofuels to be used in the fuel?
9. What are the energy, economic and environmental benefits and/or costs of requiring a percentage of biofuels to be used in number 2 heating oil?
10. What barriers to Maine's biofuel market will this policy address and how well will it address them?
11. What are the current incentives for biofuels in Maine, New England and the United States, and what are your recommendations to promote biofuels and other forms of biomass for heating applications?
12. What are the energy benefits (or costs) of a biofuels/biomass mandate for number 2 heating oil? Include price, cost, environmental, energy security, jobs data/information.
13. If biofuels are required in number 2 heating oil, would it stimulate new investment in biofuels and biomass in Maine?
14. What are the budget/cost implications on the State of Maine if biofuels are required in number 2 heating oil and does Maine have the capacity to implement and enforce this requirement?
15. How effective is this type of policy in other States, including New England?

16. Please identify any other policy recommendations that may encourage or promote the biofuels, biomass and forestry industries in Maine?
17. Please address any other issues within your interest or expertise, including technology, feedstock competition, cost/price, demand/supply, policy and other issues?

Appendix B – Maine Businesses Producing Waste Restaurant Grease

Amigos Mexican Restaurant
Portland, Maine
Asylum Sports Bar
Portland, Maine
Atlantica
Camden, Maine
Bayley's Campground
Scarborough, Maine
Bayside Bowl
Portland, Maine
Bayview Lobster
Camden, Maine
Ben Kay Sushi Bar
Portland, Maine
Bernie's
Falmouth, Maine
Brickhouse
Searsport, Maine
Cake Restaurant
Portland, Maine
Chiang Mai
Portland, Maine
Cinque Terre
Portland, Maine
Civic Center
Portland, Maine
Colucci's
Portland, Maine
Darby's
Belfast, Maine
David's Creative Cuisine
Portland, Maine
Dimitri's Restaurant
Scarborough, Maine
Don's Lunch
Westbrook, Maine
Dos Amigos
- Northport, Maine
Dry Dock
Biddeford, Maine
Duckfat
Portland, Maine
Dyers Variety
Portland, Maine
Eastland Park Hotel
Portland, Maine
El Rayo
Portland, Maine
Empire Dine and Dance
Portland, Maine
Fasulo's
Portland, Maine
Finch's Restaurant
Falmouth, Maine
Fireside Restaurant
Auburn, Maine
Foreside Tavern
Falmouth, Maine
Forest Gardens Bar & Grill
Portland, Maine
Gilbert's Chowderhouse
Portland, Maine
Gilbert's Windham
Windham, Maine
Golden Rooster
Saco, Maine
Greek Corner
Portland, Maine
Hi Bombay
Portland, Maine
Holiday Inn by the Bay
Portland, Maine
Hot Suppa
Portland, Maine
Howie's Pub
Portland, Maine
Johnny's
Falmouth, Maine
Litza's Pizzeria
Portland, Maine
Mathew's Bar & Grill
Portland, Maine
Mazies
Chelsea, Maine
Moran's Market
Portland, Maine
Nona's Pantry
Scarborough, Maine
Norm's Bar and Grill
Portland, Maine
Northern Gardens Restaurant
Westbrook, Maine
Nosh
Portland, Maine
Old Port Sandwich Shop
Portland, Maine
Painted Turtle
Gorham, Maine
Old Port Sea Grill
Portland, Maine
Old Port Tavern
Portland, Maine
Olive Cafe
Portland, Maine
Oriental Table
Portland, Maine
Paolina's
Camden, Maine

Pit Stop
Unity, Maine
Pita Pocket
Portland, Maine
Port of Call Restaurant & Lounge (Holiday Inn By The Bay)
Portland, Maine
Portland Country Club
Falmouth, Maine
Portland Pie Company
Falmouth, Maine
Primo
Rockland, Maine
Ribolita
Portland, Maine
Ricetta's of Falmouth
Falmouth, Maine
Ricetta's of South Portland
South Portland, Maine
Rockland Cafe
Rockland, Maine
Sabieng Thai
Portland, Maine
Seafood Center
Arundel, Maine
Sebago Brewing Company
Portland, Kennebunk, Gorham and Scarborough, Maine
Seng Thai
Portland, Maine
Sengchai Thai Cuisine
Portland, Maine
Shay's Grill Pub
Portland, Maine
SMCC
South Portland, Maine
Tandoor
Portland, Maine
Terroni's
Portland, Maine
Thai Me
Maine
Thatcher's
South Portland and Gorham, Maine
The Barn
Belfast, Maine
The Foreside Tavern & Side Bar
Falmouth, Maine
The Good Table
Cape Elizabeth, Maine
The Station
Portland, Maine
Three Dollar Dewey's
Portland, Maine
TJ's Pizza
Biddeford, Maine
Tu Casa
Portland, Maine
Twenty Milk Street (The Regency Hotel)
Portland, Maine
USM Gorham
Gorham, Maine
Varney's
Windsor, Maine
Venue - Portland, Maine
Waterfront - Camden, Maine
Willow's
South Portland, Maine
White Lion Bistro
Windsor, Maine
Wok n Roll
Biddeford, Maine
Yosaku Japanese Restaurant
- Portland, Maine
50 Local
Kennebunk, Maine

Source: http://www.mainestandardbiofuels.com

APPENDIX C – U.S. Biodiesel Overview 2001 – 2009

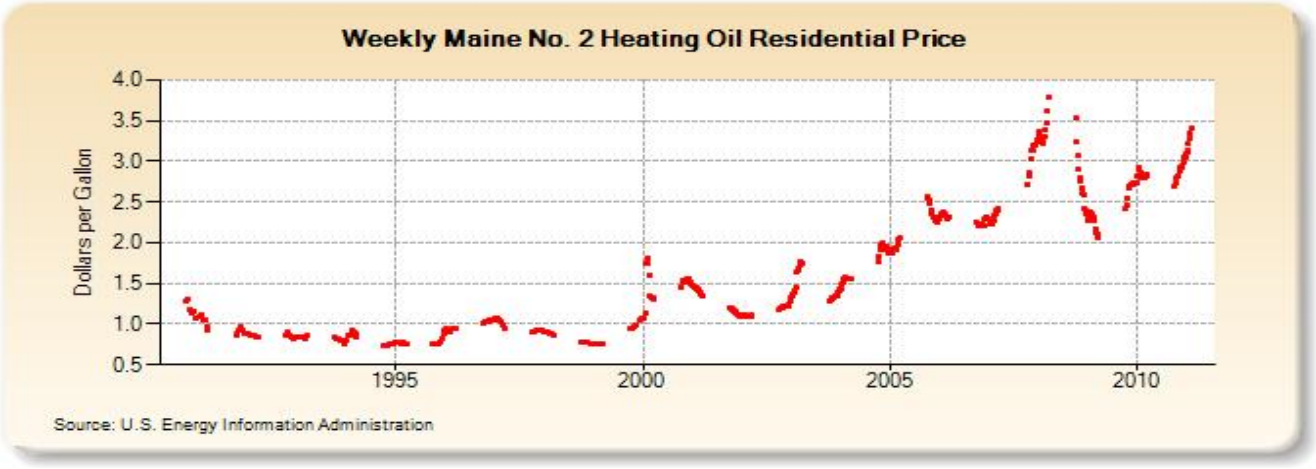
Biofuels Overview (Energy Information Administration)

Biofuels Overview, 2004 - 2008 (Trillion Btu)					
Type	**2004**	**2005**	**2006**	**2007**	**2008**
Ethanol					
Feedstock[1]	484	552	688	914	1,300
Losses and Coproducts[2]	203	230	285	376	531
Denaturant[3]	8	9	11	14	21
Production[4]	289	331	414	553	790
Net Imports[5]	13	12	62	37	45
Stock Change[6]	*	-2	11	6	13
Consumption[4]	301	344	465	584	821
Consumption minus Denaturant	293	335	453	569	800
Biodiesel					
Feedstock[7]	4	12	32	63	88
Losses and Coproducts[8]	*	*	*	1	1
Production[9]	4	12	32	62	87
Net Imports[10]	*	*	1	-17	-46
Stock Change[11]	-	-	-	-	-
Balancing Item[12]	-	-	-	-	-
Consumption	3	12	33	46	40

[1] Total corn and other biomass inputs to the production of fuel ethanol.
[2] Losses and coproducts from the production of ethanol. Does not include natural gas, electricity, and other non-biomass energy used in the production of ethanol.
[3] Petroleum, typically pentanes plus or conventional motor gasoline, added to ethanol to make it unfit for human consumption.
[4] Includes denaturant.
[5] Fuel ethanol imports. There are no exports. Includes denaturant.
[6] A negative number indicates a decrease in stocks and a positive number indicates an increase. Includes denaturant.
[7] Total soy bean oil and other biomass inputs to the production of biodiesel.
[8] Losses and coproducts from the production of biodiesel. Does not include natural gas, electricity, and other nonbiomass energy used in the production of biodiesel.
[9] Production of biofuels for use as diesel fuel substitutes or additives.
[10] Net imports equal imports minus exports.
[11] A negative number indicates a decrease in stocks and a positive number indicates an increase.
[12] Calculated as biodiesel consumption and biodiesel stock change minus biodiesel production and net imports.

* = Less than 0.5 trillion Btu.
- = No data reported.
Note: Totals may not equal sum of components due to independent rounding.

APPENDIX D – Maine Heating Oil Prices



Weekly Maine No. 2 Heating Oil Residential Price (Dollars per Gallon)

Year-Month	Week 1		Week 2		Week 3		Week 4		Week 5	
	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
1990-Oct	10/01	1.277			10/15	1.314				
1990-Nov	11/05	1.186			11/19	1.126				
1990-Dec	12/03	1.161			12/17	1.069				
1991-Jan	01/07	1.086			01/21	1.119				
1991-Feb	02/04	1.056			02/18	1.043				
1991-Mar	03/04	0.975			03/18	0.930				
1991-Oct	10/07	0.858			10/21	0.892				
1991-Nov	11/04	0.928			11/18	0.964				
1991-Dec	12/02	0.915			12/16	0.893				
1992-Jan	01/06	0.875			01/20	0.865				
1992-Feb	02/03	0.866			02/17	0.867				
1992-Mar	03/02	0.847			03/16	0.831				
1992-Oct	10/05	0.868			10/19	0.898				
1992-Nov	11/02	0.864			11/16	0.851				
1992-Dec	12/07	0.826			12/21	0.840				
1993-Jan	01/04	0.845			01/18	0.848				

Year-Month	Week 1		Week 2		Week 3		Week 4		Week 5	
	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
1993-Feb	02/01	0.843			02/15	0.849				
1993-Mar	03/01	0.817			03/15	0.858				
1993-Oct	10/04	0.832			10/18	0.827				
1993-Nov	11/01	0.810			11/15	0.796				
1993-Dec	12/06	0.789			12/20	0.765				
1994-Jan	01/03	0.791			01/17	0.854			01/31	0.865
1994-Feb	02/07	0.909	02/14	0.918	02/21	0.898	02/28	0.893		
1994-Mar	03/07	0.892			03/21	0.843				
1994-Oct	10/03	0.732			10/17	0.727				
1994-Nov	11/07	0.727			11/21	0.748				
1994-Dec	12/05	0.747			12/19	0.754				
1995-Jan	01/02	0.779			01/16	0.774				
1995-Feb	02/06	0.765			02/20	0.773				
1995-Mar	03/06	0.767			03/20	0.751				
1995-Oct	10/02	0.758			10/16	0.748				
1995-Nov	11/06	0.751			11/20	0.788				
1995-Dec	12/04	0.827			12/18	0.874				
1996-Jan	01/01	0.922			01/15	0.937				
1996-Feb	02/05	0.914			02/19	0.944				
1996-Mar	03/04	0.954			03/18	0.945				
1996-Oct	10/07	1.015			10/21	1.037	10/28	1.037		
1996-Nov	11/04	1.028	11/11	1.023	11/18	1.037	11/25	1.046		
1996-Dec	12/02	1.043	12/09	1.049	12/16	1.055	12/23	1.062	12/30	1.062
1997-Jan	01/06	1.066	01/13	1.066	01/20	1.064	01/27	1.057		
1997-Feb	02/03	1.056			02/17	1.032				
1997-Mar	03/03	0.993			03/17	0.949				
1997-Oct	10/06	0.900			10/20	0.910				
1997-Nov	11/03	0.917			11/17	0.926				
1997-Dec	12/01	0.931			12/15	0.928				
1998-Jan	01/05	0.910			01/19	0.900				
1998-Feb	02/02	0.894			02/16	0.889				
1998-Mar	03/02	0.878			03/16	0.870				
1998-Oct	10/05	0.784			10/19	0.785				
1998-Nov	11/02	0.786			11/16	0.785				
1998-Dec	12/07	0.760			12/21	0.753				

Year-Month	Week 1		Week 2		Week 3		Week 4		Week 5	
	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
1999-Jan	01/04	0.751			01/18	0.766				
1999-Feb	02/01	0.767			02/15	0.758				
1999-Mar	03/01	0.756			03/15	0.765				
1999-Oct	10/04	0.945			10/18	0.955				
1999-Nov	11/01	0.966			11/15	0.990				
1999-Dec	12/06	1.043			12/20	1.066				
2000-Jan	01/03	1.075			01/17	1.134	01/24	1.742	01/31	1.749
2000-Feb	02/07	1.817	02/14	1.599	02/21	1.342	02/28	1.319		
2000-Mar	03/06	1.319	03/13	1.322	03/20	1.302				
2000-Oct	10/02	1.461	10/09	1.460	10/16	1.534	10/23	1.517	10/30	1.518
2000-Nov	11/06	1.515	11/13	1.510	11/20	1.538	11/27	1.557		
2000-Dec	12/04	1.551	12/11	1.551	12/18	1.517	12/25	1.486		
2001-Jan	01/01	1.482	01/08	1.473	01/15	1.454	01/22	1.446	01/29	1.443
2001-Feb	02/05	1.430	02/12	1.424	02/19	1.410	02/26	1.395		
2001-Mar	03/05	1.359	03/12	1.353	03/19	1.339				
2001-Oct	10/01	1.205	10/08	1.197	10/15	1.191	10/22	1.174	10/29	1.172
2001-Nov	11/05	1.162	11/12	1.147	11/19	1.128	11/26	1.121		
2001-Dec	12/03	1.116	12/10	1.113	12/17	1.104	12/24	1.101	12/31	1.110
2002-Jan	01/07	1.111	01/14	1.110	01/21	1.109	01/28	1.107		
2002-Feb	02/04	1.099	02/11	1.098	02/18	1.096	02/25	1.094		
2002-Mar	03/04	1.092	03/11	1.096	03/18	1.106				
2002-Oct	10/07	1.185	10/14	1.192	10/21	1.199	10/28	1.209		
2002-Nov	11/04	1.214	11/11	1.211	11/18	1.214	11/25	1.218		
2002-Dec	12/02	1.222	12/09	1.224	12/16	1.231	12/23	1.284	12/30	1.322
2003-Jan	01/06	1.350	01/13	1.368	01/20	1.386	01/27	1.412		
2003-Feb	02/03	1.459	02/10	1.635	02/17	1.672	02/24	1.679		
2003-Mar	03/03	1.717	03/10	1.777	03/17	1.746				
2003-Oct	10/06	1.274	10/13	1.290	10/20	1.305	10/27	1.314		
2003-Nov	11/03	1.317	11/10	1.315	11/17	1.323	11/24	1.342		
2003-Dec	12/01	1.345	12/08	1.355	12/15	1.386	12/22	1.412	12/29	1.420
2004-Jan	01/05	1.428	01/12	1.487	01/19	1.518	01/26	1.547		
2004-Feb	02/02	1.565	02/09	1.572	02/16	1.562	02/23	1.559		
2004-Mar	03/01	1.557	03/08	1.554	03/15	1.553				
2004-Oct	10/04	1.760	10/11	1.837	10/18	1.921	10/25	1.978		
2004-Nov	11/01	1.995	11/08	1.962	11/15	1.961	11/22	1.966	11/29	1.966

Year-Month	Week 1		Week 2		Week 3		Week 4		Week 5	
	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
2004-Dec	12/06	1.918	12/13	1.881	12/20	1.907	12/27	1.906		
2005-Jan	01/03	1.890	01/10	1.868	01/17	1.879	01/24	1.913	01/31	1.931
2005-Feb	02/07	1.920	02/14	1.913	02/21	1.910	02/28	1.969		
2005-Mar	03/07	2.038	03/14	2.061						
2005-Oct	10/03	2.564	10/10	2.540	10/17	2.517	10/24	2.477	10/31	2.406
2005-Nov	11/07	2.365	11/14	2.322	11/21	2.306	11/28	2.309		
2005-Dec	12/05	2.267	12/12	2.257	12/19	2.303	12/26	2.302		
2006-Jan	01/02	2.321	01/09	2.351	01/16	2.340	01/23	2.357	01/30	2.375
2006-Feb	02/06	2.360	02/13	2.333	02/20	2.295	02/27	2.298		
2006-Mar	03/06	2.323	03/13	2.312						
2006-Oct	10/02	2.253	10/09	2.218	10/16	2.213	10/23	2.222	10/30	2.218
2006-Nov	11/06	2.205	11/13	2.220	11/20	2.204	11/27	2.205		
2006-Dec	12/04	2.292	12/11	2.313	12/18	2.316	12/25	2.297		
2007-Jan	01/01	2.293	01/08	2.248	01/15	2.230	01/22	2.221	01/29	2.242
2007-Feb	02/05	2.280	02/12	2.338	02/19	2.346	02/26	2.388		
2007-Mar	03/05	2.398	03/12	2.410						
2007-Oct			10/08	2.707	10/15	2.724	10/22	2.810	10/29	2.859
2007-Nov	11/05	3.040	11/12	3.142	11/19	3.135	11/26	3.199		
2007-Dec	12/03	3.196	12/10	3.206	12/17	3.251	12/24	3.243	12/31	3.318
2008-Jan	01/07	3.364	01/14	3.343	01/21	3.298	01/28	3.253		
2008-Feb	02/04	3.242	02/11	3.229	02/18	3.294	02/25	3.393		
2008-Mar	03/03	3.467	03/10	3.619	03/17	3.791				
2008-Oct	10/06	3.527	10/13	3.231	10/20	3.071	10/27	2.894		
2008-Nov	11/03	2.800	11/10	2.758	11/17	2.674	11/24	2.609		
2008-Dec	12/01	2.590	12/08	2.426	12/15	2.406	12/22	2.350	12/29	2.265
2009-Jan	01/05	2.285	01/12	2.371	01/19	2.385	01/26	2.361		
2009-Feb	02/02	2.339	02/09	2.314	02/16	2.265	02/23	2.170		
2009-Mar	03/02	2.121	03/09	2.110	03/16	2.065				
2009-Oct	10/05	2.415	10/12	2.466	10/19	2.554	10/26	2.673		
2009-Nov	11/02	2.692	11/09	2.698	11/16	2.706	11/23	2.712	11/30	2.724
2009-Dec	12/07	2.734	12/14	2.737	12/21	2.730	12/28	2.737		
2010-Jan	01/04	2.815	01/11	2.916	01/18	2.909	01/25	2.870		
2010-Feb	02/01	2.804	02/08	2.808	02/15	2.808	02/22	2.821		
2010-Mar	03/01	2.808	03/08	2.829	03/15	2.832				
2010-Oct	10/04	2.696	10/11	2.737	10/18	2.788	10/25	2.810		

Year-Month	Week 1		Week 2		Week 3		Week 4		Week 5	
	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
2010-Nov	11/01	2.814	11/08	2.873	11/15	2.929	11/22	2.935	11/29	2.939
2010-Dec	12/06	2.992	12/13	3.042	12/20	3.054	12/27	3.095		
2011-Jan	01/03	3.107	01/10	3.134	01/17	3.219	01/24	3.284	01/31	3.338
2011-Feb	02/07	3.399								

This page intentionally left blank.

APPENDIX E – Selected Biofuel Resources

Biodiesel Suppliers, Retailers and Distributors
http://www.epa.gov/ne/eco/diesel/pdfs/biodiesel-suppliers.pdf

Biofuels Incentives – A Summary of Federal Programs
http://ncseonline.org/NLE/CRSreports/10Oct/R40110.pdf

Biomass Thermal Energy Council
http://www.biomassthermal.org/

Brookhaven National Laboratories
www.bnl.gov/est/erd/biofuel

Energy Information Administration – Biofuels Data Analysis
www.eia.doe.gov

Governor's Office of Energy Independence and Security
www.maine.gov/oeis

Maine Energy Marketers Association
www.maineenergymarketers.com

National Biodiesel Board
www.biodiesel.org

National Oilheat Research Alliance
www.nora-oilheat.org

U.S. Department of Agriculture – Bioenergy and Biofuels
www.usda.gov

U.S. Department of Energy Biomass Program
www.eere.energy.gov/biomass

This page intentionally left blank.

References

bio-era, BIO Economic Research Associates. (February 2009). "U.S. Economic Impact of Advanced Biofuels Production: Perspectives to 2030."

Biomass Energy Resource Center. (August 14, 2009). Biomass Energy: Efficiency, Scale, and Sustainability.

Biomass Thermal Energy Council. (June 2010). *Legislation Fact Sheet. S. 3188 – American Renewable Biomass Heating Act of 2010.* Retrieved December 2010, from http://www.biomassthermal.org/news/newsletterFiles/June2010.htm.

Brookhaven National Laboratory. Energy Resources Division. (Accessed January 2011). Biofuel Research. http://www.bnl.gov/est/erd/biofuel/bnl.asp.

Butcher, Tom. Brookhaven National Laboratory. (March 18, 2010). "New Residential Liquid Fueled Technologies That Work," presented to the National Oil Research Association meeting.

Chewonki Biodiesel Project. Accessed December 2010 at www.chewonki.org/pathways/pathways_biodiesel.asp.

Congressional Research Service. (March 3, 2010). "Issue Statement on Agriculture-Based Biofuels."

Cooper, Coralie and Matt Solomon. Northeast States for Coordinated Air Use Management. (October 14, 2008). "What is a Low Carbon Fuel Standard?" Presented to Low Carbon Fuel Standard Workshop, Yale University, http://www.nescaum.org/documents/low-carbon-fuel-standard-workshop/.

Dickerson, Kate, Jonathan Rubin and Jacob Kavkewitz. (Revised November 2007). Margaret Chase Smith Policy Center. Forest Bioproducts Research Initiative. *Biomass and Biofuels in Maine: Estimating Supplies for Expanding the Forest Products Industry.*

Efficiency Maine. *Biofuels.* Accessed December 2010 at www.efficiencymaine.com/renewable-energy/biofuels.

Energy Communications Council. (August 18, 2010). http://www.heatingnews.org/heatingoilnews.php?IID=16.

Environmental and Energy Study Institute. (November 1, 2007). *Can the States Meet the Proposed 15% National Renewable Portfolio Standard?* http://www.eesi.org/110107_National_RPS.

Fitzpatrick, Dr. Stephen. Biofine Technology. (March 18, 2010). "The Biofine Process," Presentation to NORA, www.nora-oilheat.org.

Garrett, Josh. (April 8, 2010). Northeastern States' Low Carbon Fuel Standard Plan Could Affect Heating Oil Prices, heatingoil.com.

Gehlhar, Mark, Ashley Winston and Agapi Somwaru. (October 2010). U.S. Department of Agriculture, Economic Research Service. Effects of Increased Biofuels on the U.S. Economy in 2022.

Giffen, Alec. (November 2010). Maine Forest Service, Department of Conservation. E-Mail Correspondence.

Governor's Office of Energy Independence and Security. (January 15, 2009). *State of Maine Comprehensive Energy Plan 2008 – 2009.*

Governor's Office of Energy Independence and Security. (2008-2009). *State of Maine Energy Emergency Plan.*

Greater Portland Council of Governments, Maine Clean Communities, Biofuels Summit. (December 2009). http://www.gpcog.org/Transportation_and_Land_Use/Maine_Clean_Communities.php#67.

Greater Portland Council of Governments, Maine Clean Communities. (December 2010). Clean Fuel Vehicle Incentives. www.mainecleancommunities.gpcog.info/incentives.

Henry, Alan. (November 2010). Maine Bureau of General Services. E-Mail Correspondence.

Heatingoil.com. (May 26, 2009). "Biofuel Heating Oil."

Huber, John. (December 2010). National Oilheat Research Alliance. E-Mail Correspondence.

Huntington, Faith. (November 2010). Maine Public Utilities Commission. E-Mail Correspondence.

Independent Connecticut Petroleum Association. (Accessed December 2010). http://www.icpa.org.

Innovative Natural Resource Solutions, LLC. Prepared for the Maine Department of Economic & Community Development Office of Innovation. (June 2006). *Wood-Based Bio-Fuels and Bio-Products: A Maine Status Report.*

Kotrba, Ron. (January 2010). "Reinventing Oilheat." *Biodiesel Magazine.*

Lambert, Rebecca Rockefeller. (November 2010). Greater Portland Council of Governments. E-Mail Correspondence.

Leary, Mal. Capitol News Service. (December 12, 2010). "Maine Gets Most Federal Biofuel Help of Any State." *Bangor Daily News.*

Maine Forest Service, Department of Conservation. (July 17, 2008). Assessment of Sustainable Biomass Availability. Accessed at http://www.maine.gov/doc/mfs/pubs/pdf/biomass_memo_071708.pdf.

Maine Forest Service, Department of Conservation. (Sep. 14, 2007). *Biofuels 101: the Short Course.*

Maine State Legislature (124th). (2010). RESOLVE Chapter 210, LD 1632, Resolve, Regarding Biofuel in Number 2 Heating Oil.

Marks, Jeffrey. (January 22, 2010). Governor's Office of Energy Independence and Security. Testimony before the Maine State Legislature, Joint Standing Committee of Natural Resources. LD 1632 "An Act to Establish Biofuel and Ultra-Low Sulfur Requirements for Number 2 Home Heating Oil."

Marin, Arthur. NESCAUM. (January 22, 2010). "Air Quality, Climate Change and the Oilheat Industry," presentation to National Oil Heat Alliance.

Martin, David. (January 22, 2010). Webber Watchdog Service on behalf of the Maine Energy Marketers Association. Testimony before the Maine State Legislature, Joint Standing Committee of Natural Resources. LD 1632 "An Act to Establish Biofuel and Ultra-Low Sulfur Requirements for Number 2 Home Heating Oil."

Manomet Center for Conservation Sciences. (June 2010). Prepared for Commonwealth of Massachusetts, Department of Energy Resources. *Biomass Sustainability and Carbon Policy Study.*

Massachusetts Department of Energy Resources. (June 30, 2010). Massachusetts Advanced Biofuels Mandate Program Announcement. http://www.mass.gov/Eoeea/docs/doer/renewables/biofuels-mandate-announcement-jun302010.pdf.

Massachusetts Oilheat Association. (Accessed December 2010). www.massoilheat.org.

McCormick, Bob. National Renewable Energy Laboratory. (March 18, 2010). "Biodiesel Utilization in the U.S." Presentation to National Oil Research Alliance.

Michaels, Ted. (November 2010). Energy Recovery Council. *The 2010 ERC Directory of Waste-to-Energy Plants.*

Minnesota Department of Commerce. (Accessed January 2011). http://www.state.mn.us/portal/mn/jsp/home.do?agency=Commerce.

Morgan, Erika and Rebecca Rockefeller. Maine Energy Investment Corporation. (November 2006). *Biodiesel Policy Options and Evaluation. Biodiesel for Maine.*

National Agricultural Law Center. *States' Biofuels Statutes.* Retrieved December 2010, from http://www.nationalaglawcenter.org/assets/biofuels/index.html.

National Biodiesel Board. (September 21, 2009) Press Statement. http://nbb.grassroots.com/09Releases/BioheatFuture.

National Biodiesel Board. Biodiesel Myths and Facts. Retrieved December 2010, from http://www.biodiesel.org/pdf_files/fuelfactsheets/Myths_Facts.pdf.

Northeast Biomass Thermal Energy Council. (April 2010). Heating the Northeast with Renewable Biomass: A Bold Vision for 2025. Accessed at www.nebioheat.org.

NYSERDA. (May 2004). *Statewide Feasibility Study for a Potential New York State Biodiesel Industry.*

OBP Weekly Biomass in the News. (Nov. 17, 2010). "America Needs New Investment in the Next Generation of Biofuels."

Olesen, Thor. (Fall/Winter 2008). "BioEnergy and the Forest Products Industry in the Alantica Region." *Maine Policy Review.*

Py, Jamie. (2010). Maine Energy Marketers Association. Personal Communication and E-Mail Correspondence.

Py, Jamie. (January 22, 2010). Maine Energy Marketers Association. Testimony before the Maine State Legislature, Joint Standing Committee of Natural Resources. LD 1632 "An Act to Establish Biofuel and Ultra-Low Sulfur Requirements for Number 2 Home Heating Oil."

Quinn, John E. (Jan. 22, 2010). New England Petroleum Council. Testimony before the Maine State Legislature, Joint Standing Committee of Natural Resources. LD 1632 "An Act to Establish Biofuel and Ultra-Low Sulfur Requirements for Number 2 Home Heating Oil."

Rockefeller, Rebecca. Prepared for the Maine Office of Energy Independence and Security. (January 2008) *Liquid Biofuels Policy for Maine: A Report to the State Legislature.*

Schnepf, Randy. Specialist in Agricultural Policy. (March 3, 2010). "CRS Issue Statement on Agricultural-Based Biofuels." Congressional Research Service.

Severance, Ronald W. Maine Department of Environmental Protection. (December 2010). *Regional Low Carbon Fuel Standard Program: An Overview of the Northeast and Mid-Atlantic States' Clean Transportation Initiative.* E-Mail Correspondence.

Strauss, Dr. William. (January 2011). FutureMetrics, LLC. "How to Cure Maine's Addition to Oil: A Roadmap to Avoiding Economic Disaster in Maine and the Other Regional States."

Strauss, Dr. William. (July 2010). FutureMetrics, LLC. Prepared for the Northeast Biomass Thermal Working Group. *Gulf of Mexico Offshore Oil and the Northeastern United States' Dependence on Heating Oil.* E-Mail Correspondence.

Stubbs, Megan, Analyst in Agricultural Conservation and Natural Resources Policy. (June 22, 2010). "Biomass Crop Assistance Program (BCAP): Status and Issues." Congressional Research Service.

Therriault, Jim. (December 2010). Sprague Energy. E-Mail Correspondence.

Underwriters Laboratories, Inc. (Revised June 18, 2008). Prepared for the National Biodiesel Board. *Fact Finding Investigation: Report on the Interchangeability of B5 Biodiesel Blend Within Residential Oil-Burner Appliances Intended for Use with No. 2 Fuel Oil.* File: MP4132, Project: 06CA55893.

Urbanchuk, John. Project Manager. (Revised May 5, 2004). LECG, LLC. Prepared for New York State Energy Research and Development Authority. *Statewide Feasibility*

Study for a Potential New York State Biodiesel Industry. Accessed at http://www.nyserda.org/publications/biodieselreport.pdf.

U.S. Department of Agriculture. (June 23, 2010). *A USDA Regional Roadmap to Meeting the Biofuels Goals of the Renewable Fuels Standard by 2022.*

U.S. Department of Energy, Energy Information Administration. *2009 Annual Energy Review*, http://www.eia.doe.gov/energy_in_brief/major_energy_sources_and_users.cfm.

U.S. Department of Energy, Energy Information Administration. *Heating Oil Explained,* http://www.eia.doe.gov/energyexplained/index.cfm?page=heating_oil_use.

U.S. Department of Energy, Energy Information Administration. *Residential Heating Oil Prices*, http://www.eia.gov/bookshelf/brochures/heatingoil/index.html

U.S. Environmental Protection Agency. (November 2011). "2011 Standards for Renewable Fuel Standard Program (RFS2): Notice of Final Rulemaking. Accessed at www.epa.gov/otaq/fuels/renewablefuels/regulations.htm.

U.S. Environmental Protection Agency and National Renewable Energy Laboratory. Sep. 15, 2009). *State Bioenergy Primer: Information and Resources for States on Issues, Opportunities, and Options for Advancing Bioenergy.*

U.S. Environmental Protection Agency. New England Office. (May 2007). *What You Should Know About Biodiesel in New England.*

Voegele, Erin. (September 2010). "Biodiesel Support Remains Strong Despite Massachusetts' Suspension." *Biodiesel Magazine*.

Wilson, Elizabeth A. (December 2010). Department of Earth Sciences and Margaret Chase Smith Policy Center, University of Maine. E-Mail Correspondence.

Yacobucci, Brent D., Specialist in Energy and Environmental Policy. (Sep. 15, 2010). Congressional Research Service. "Biofuels Incentives: A Summary of Federal Programs."